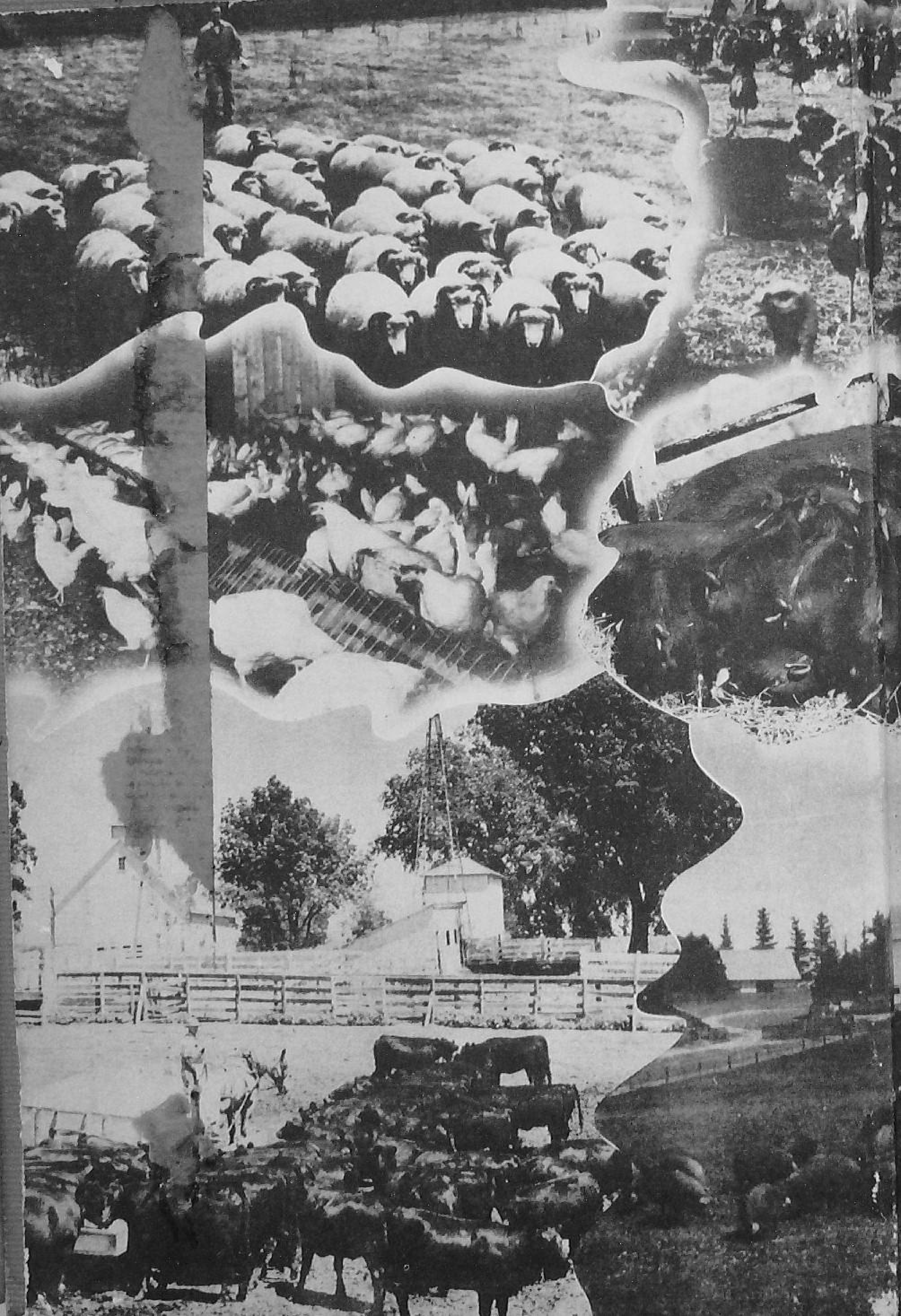
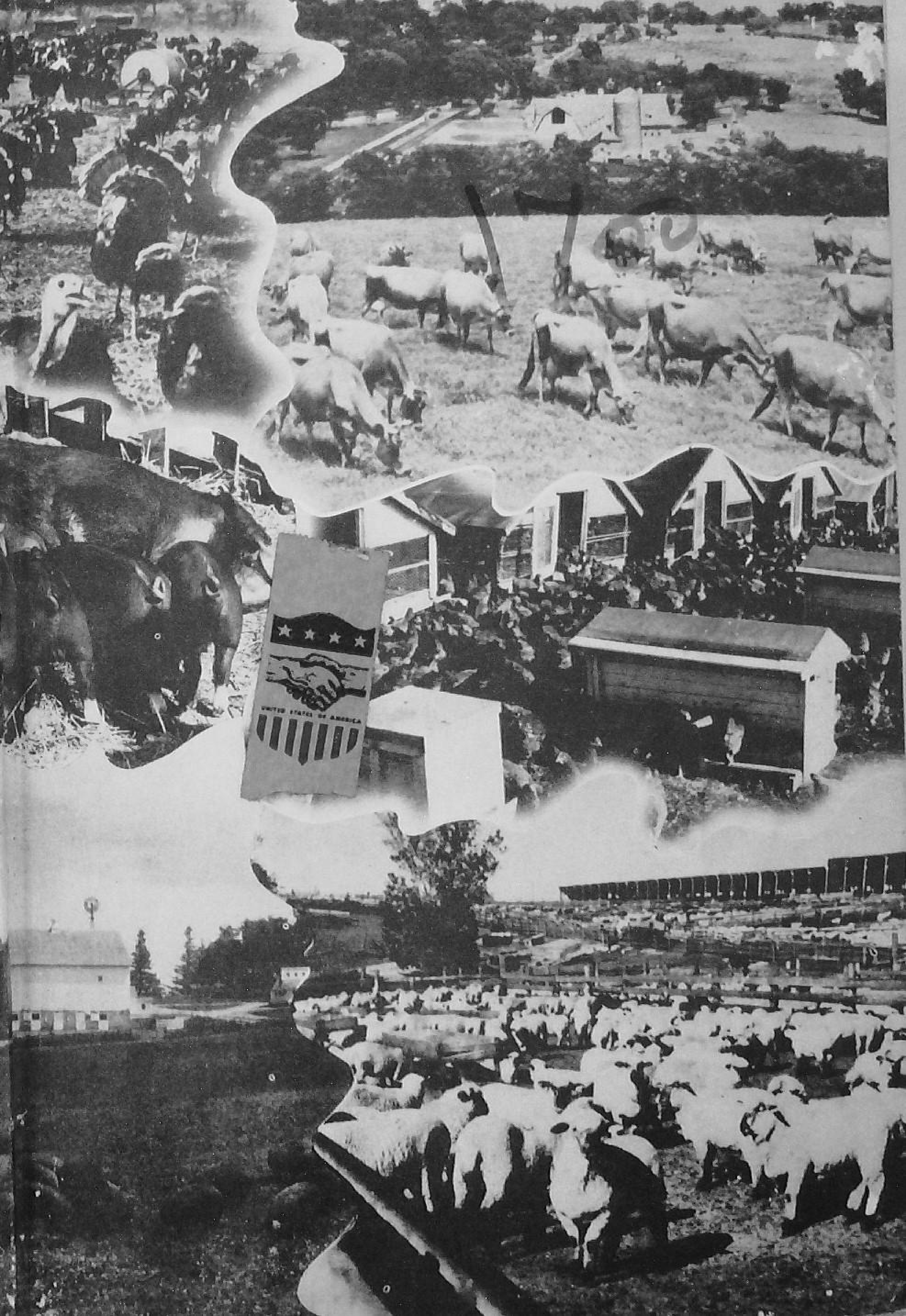
Livestock and Poultry Production

BUNDY and DIGGINS

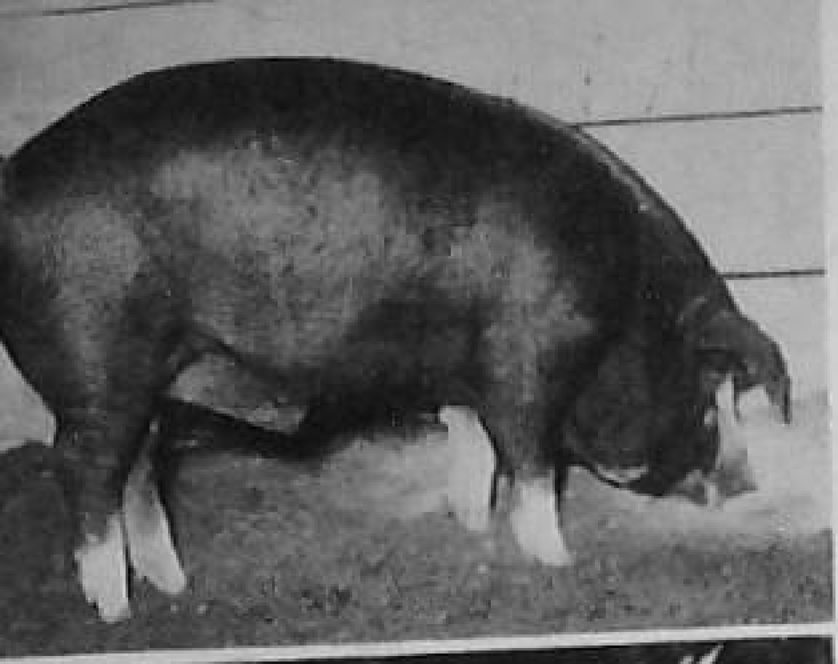


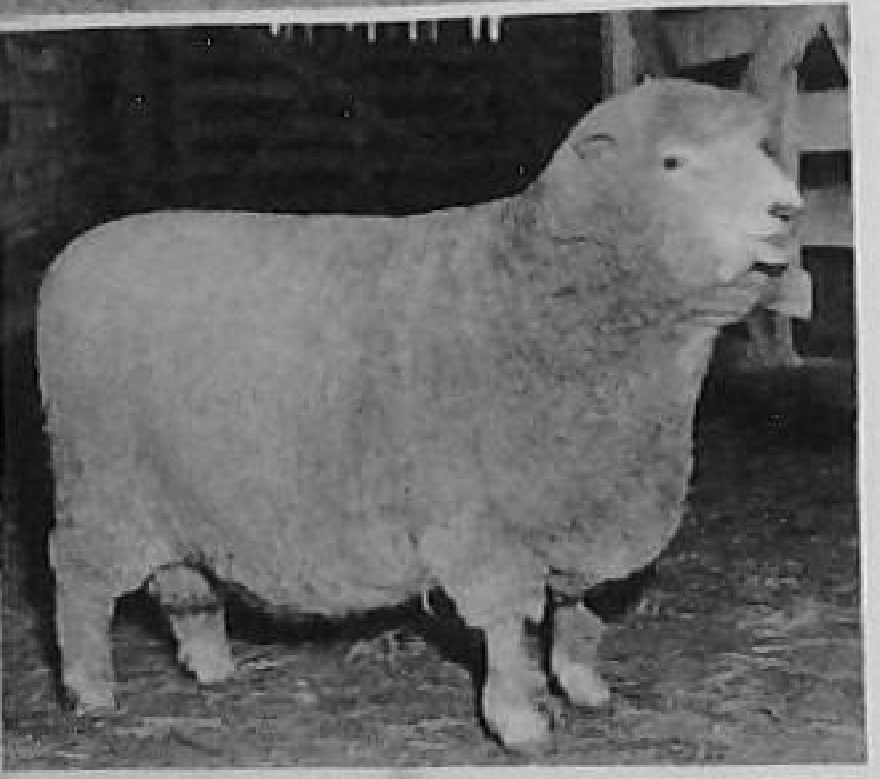
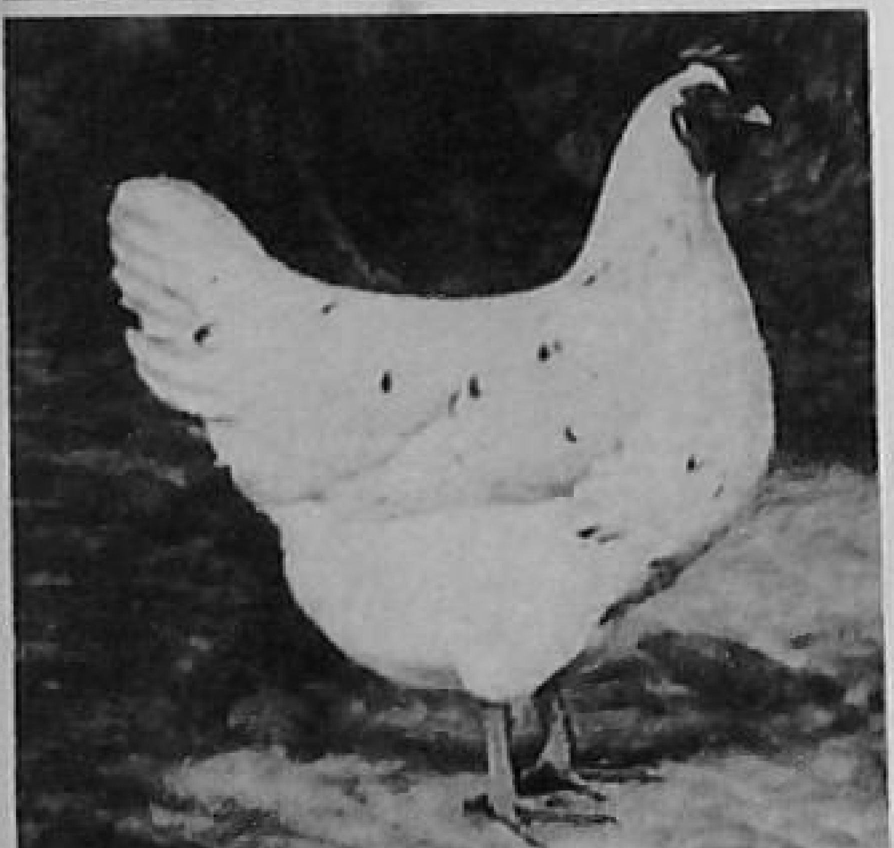

UNITED STATES OF AMERICA

LBN 4147/~~125~~
L. B. No. 59
124
87
BLOCK DEVELOPMENT OFFICE
Date 9-9-1957
TIRUVANNAMALAI

Livestock and Poultry Production

OFFICE OF THE PRINCIPAL
10 MAY 1962
RURAL EXTENSION TRAINING CENTRE
23, 15.5. 608



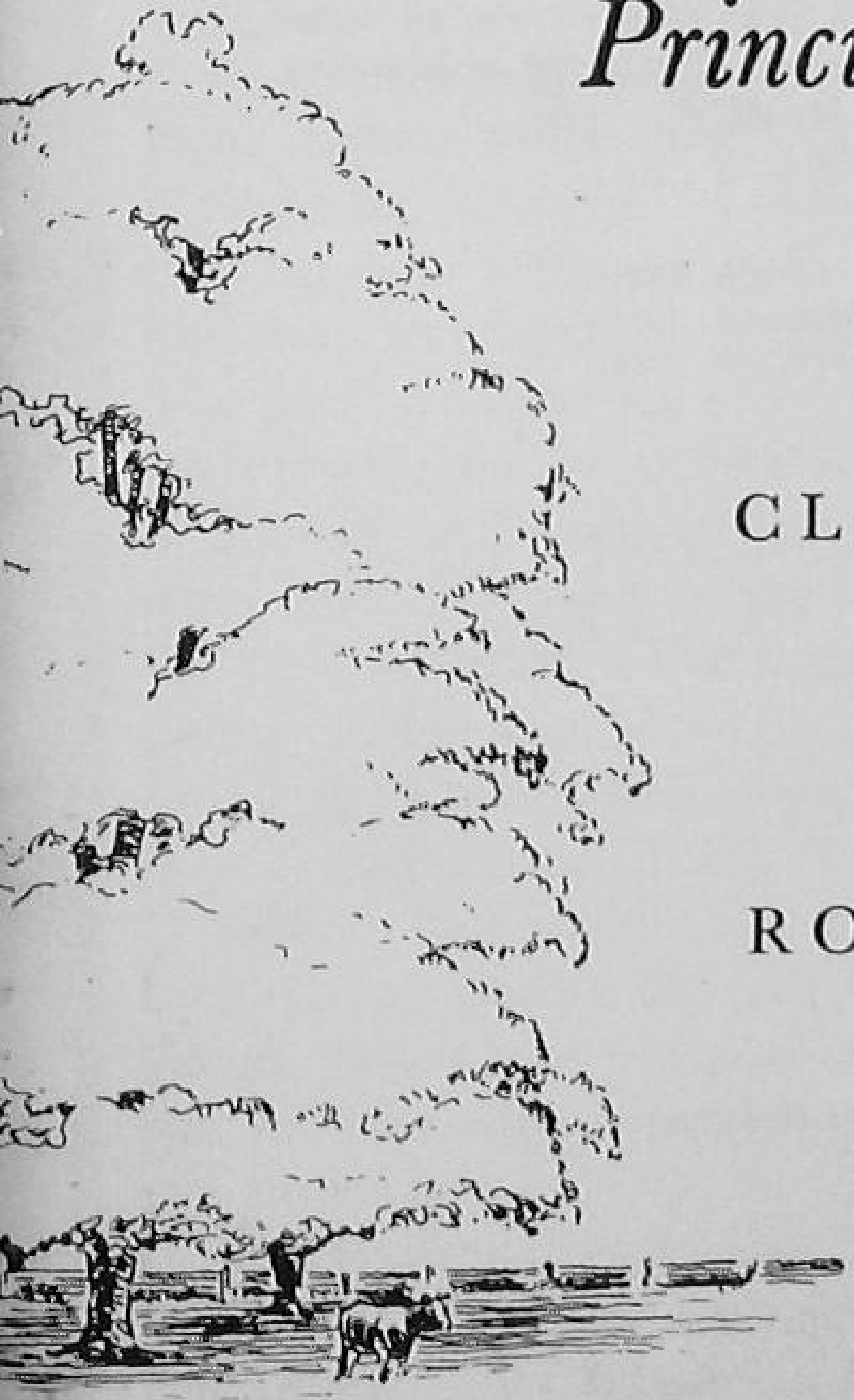



Livestock

4147

and Poultry Production

Principles and Practices



CLARENCE E. BUNDY

Associate Professor of Agricultural Education, Iowa State College

and

RONALD V. DIGGINS

Vocational Agriculture Instructor Eagle Grove, Iowa

PRENTICE-HALL, INC. • Englewood Cliffs, N. J.

Copyright, 1954, by PRENTICE-HALL, INC., Englewood Cliffs, N. J. All rights reserved. No part of this book may be reproduced in any form, by mimeograph or any other means, without permission in writing from the publishers.
L. C. Card No.: 54–7457

First Printing .... May, 1954
Second Printing ...... December, 1954
Third Printing ...... September, 1955

PRINTED IN THE UNITED STATES OF AMERICA
53859

Preface

In this book we present the basic principles and practices of livestock and poultry production. We have eliminated the necessity of reading through a maze of technical and semitechnical material for the fundamental information required for success in practical production.

We have reviewed the results of research in animal and poultry production conducted by a large number of agricultural experiment stations and by the U.S.D.A. Agricultural Research Center at Beltsville, Maryland. Livestock and poultry marketing information has been obtained from meat packing and other processing industries and from the United States Department of Agriculture. The purebred livestock breed associations have assisted us in bringing together the latest data on trends in the type and production of animals, and recent publications of many state agricultural colleges have been used in assembling some of the information that has been included. The most complete and up-to-date information needed in solving the production, management, and marketing problems in swine, beef, sheep, dairy, and poultry production has been collected in one book.

Methods and practices in animal and poultry production change rapidly, and during the past five years great changes have come about. It has been our goal to inform the reader of these changes and to assist him in improving the livestock and poultry production on his farm.

Each type of livestock has been treated separately, and the subject matter has been organized systematically so that the reader can find quickly the information desired. The descriptive material in the book has been supplemented by 350 illustrations and 59 tables.

In preparing this book we have drawn heavily upon our experiences during the past twenty-four years in farming, in vocational

agriculture, and in agricultural education work. It has been our privilege to work closely with hundreds of livestock producers. Considerable information and many of the recommended practices have been obtained directly from these farmers.

We are particularly indebted to the secretaries of the livestock breed associations; Carroll Plager of Geo. A. Hormel & Co.; Louis Thompson and Bernard Ebbing of The Rath Packing Company; Alan Williams of Wilson & Co.; Russell Plager of John Morrell & Co.; Dewey Jontz, Secretary of the Iowa Sheep Breeders Association; *Successful Farming; Wallaces' Farmer and Iowa Homestead; The Poultry Tribune; The Turkey World; Better Farming Methods;* the United States Department of Agriculture, Bureau of Animal Industry, Bureau of Agricultural Economics, and Production and Marketing Administration; and to representatives of many agricultural colleges who provided illustrative materials and research information.

We are especially grateful to Dr. Roy Kottman, Professor Arthur Anderson, Professor William LaGrange, and Dr. L. N. Hazel, of the Animal Husbandry Department; Professor Arthur Porter, of the Dairy Husbandry Department; Dr. Robert Penquite, of the Poultry Department; and to Dr. Merle Baker, of the Dairy Industry Department, Iowa State College, for assistance in the preparation of the manuscript.

Valuable assistance was received also from Dr. W. A. Craft, Director of the Regional Swine Research Center, and from a large number of vocational agriculture instructors.

We also wish to thank the following reviewers who made many helpful suggestions: Robert W. Bray, University of Wisconsin College of Agriculture; James E. Hamilton, Audubon High School, Audubon, Iowa; Clarence J. Hemming, Alexandria High School, Alexandria, Minnesota; Jess S. Smith, Lake Geneva High School, Lake Geneva, Wisconsin; and Justin Thebiay, Eagle Grove, Iowa.

CLARENCE E. BUNDY
RONALD V. DIGGINS

Table of Contents

Preface v

Livestock Feeding and Nutrition

1. Food Nutrients 3
2. Composition and Classification of Feeds 9
3. Digestion in Ruminants and in Simple-Stomach Animals . 24
4. Measuring the Value of Feeds 29

Profitable Pork Production

5. The Pork Production Industry 39
6. Selection of Breeding and Feeding Stock 45
7. Feeding and Management of the Breeding Herd . . . 82
8. Feeding and Management of Market Hogs 95
9. Control of Diseases and Parasites 142
10. Marketing Hogs 158

Profitable Beef Production

11. The Beef Production Industry 175
12. Selection of Breeding and Feeding Stock 181
13. Feeding and Management of the Breeding Herd . . . 203
14. Feeding and Management of Feeder Cattle 223
15. Marketing Beef Cattle 243

Profitable Production of Dairy Products

16. The Dairy Production Industry 259
17. Selection of Breeding Stock 271
18. Feeding and Management of Dairy Cows 297
19. Feeding and Management of Young Dairy Stock . . . 325
20. Marketing Dairy Products 334

Profitable Production of Dual-Purpose Cattle

21. Breeding and Management of Dual-Purpose Cattle 351

Cattle Diseases and Parasites

22. Keeping Cattle Healthy 359

Profitable Sheep Production

23. The Sheep Production Industry 381
24. Selection of Breeding and Feeding Stock 386
25. Feeding and Management of the Breeding Flock 411
26. Feeding and Management of Feeder Lambs 433
27. Control of Diseases and Parasites 441
28. Marketing Sheep and Wool 455

Profitable Poultry Production

29. The Poultry Production Industry 469
30. Selecting Chicks and Birds for Production 480
31. Feeding and Management of the Laying Flock 497
32. Feeding and Management of Young Chickens 516
33. Turkey Production and Management 532
34. Control of Diseases and Parasites 544
35. Marketing Poultry Products 558

Reproduction and Inheritance

36. Reproduction, Inheritance, and Pedigrees in Animal Breeding 581

Index 591

Livestock Feeding and Nutrition

< 1 >

Food Nutrients

Livestock on the farm means more meat, eggs, and milk on the tables of American homes. It means a healthier population and, consequently, a stronger America. To the farmer it means a more fertile land. Livestock converts grains and hays into valuable food products, and the residues are incorporated into the land to make it richer and more productive. The farmer's returns for his time and effort depend largely upon his knowledge of the science of animal husbandry.

To become a good livestock producer, one must first know what foods animals require in order to grow, reproduce, and furnish man with the meat, eggs, milk, and wool he desires. To understand the requirements of livestock, the individual must first become familiar with certain terms.

NUTRIENTS

The term *nutrient* means any single class of food or group of like foods that aids in the support of life and makes it possible for animals to produce the things we expect of them.

Classes and Functions of Nutrients. Nutrients are divided into five classes: carbohydrates, fats, proteins, minerals, and vitamins. Each of these nutrient classes has an important part to play in the animal body, and unless they are supplied in the feed, best results with our livestock cannot be expected.

Function of carbohydrates and fats. Carbohydrates and fats furnish the heat and energy for animals and provide the material necessary for fattening. They are very much alike, although fats are more concentrated; fats furnish 2.25 times as much heat and energy as do carbohydrates. In other words, one pound of fat will equal two and one-fourth pounds of carbohydrates in heat, energy, and fattening value.

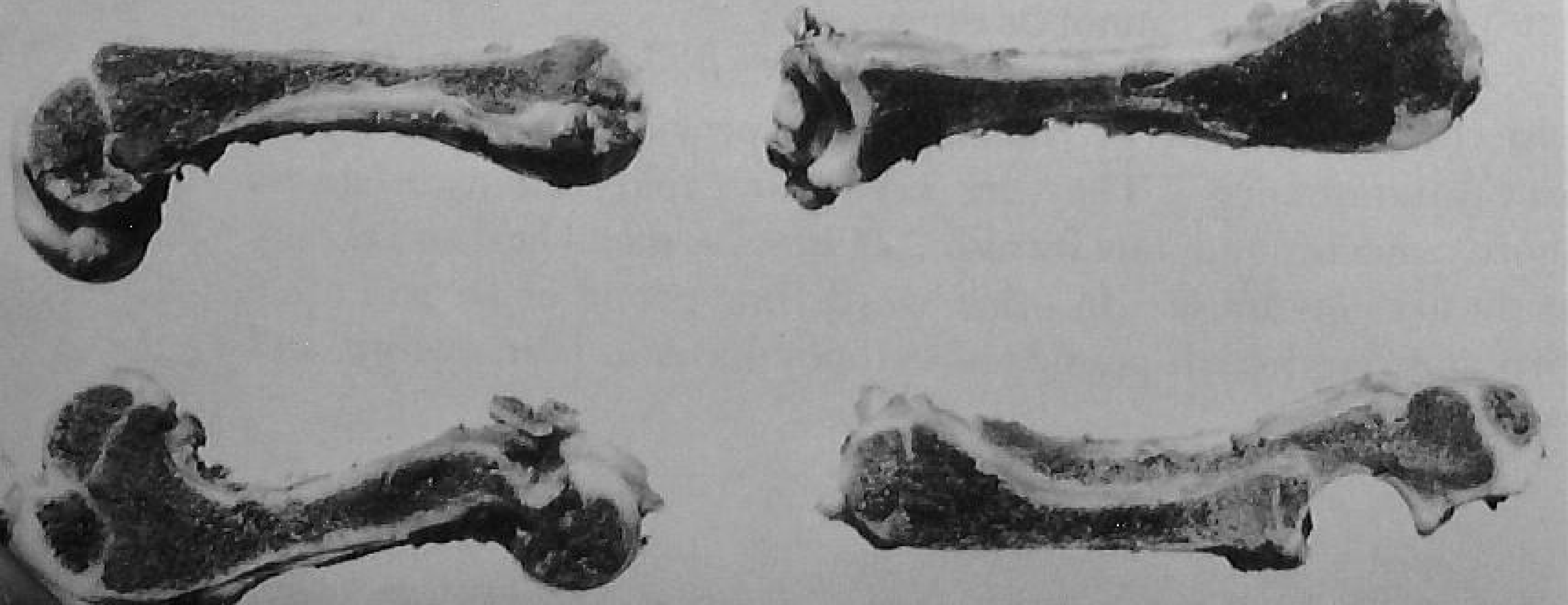
Composition of carbohydrates and fats. Carbohydrates are made up largely of sugars and starches and compose about three-fourths of all the dry matter in grains, hay, grasses, silage, fodder, and other similar feeds. Fats have the same general function as carbohydrates and consist of the same chemical compounds, but in different combinations.

Functions of proteins. Proteins are essential in livestock feeding because they help to form the greater part of the muscles, internal organs, skin, hair, wool, feathers, hoofs, and horns. Eggs and milk both contain protein; therefore, animals producing these two products or those suckling young must have enough protein for their own body needs and extra amounts for the products they produce.

Composition of proteins. Proteins are made up of a group of acids known as *amino acids.* Twenty-five or more amino acids have been identified; at least ten of these acids are needed by animals. Amino acids are nitrogen compounds and combine to form the large number of proteins that exist. As will be explained in another chapter, cattle and sheep, with four compartments to the stomach, can actually manufacture amino acids from nitrogen compounds such as urea or any high protein feed. These animals are known as *ruminants.* Because of this ability in ruminants, one or two high protein feeds are generally all that are necessary in cattle or sheep feeding.

However, hogs, known as *simple-stomach animals*, and poultry, with a similar digestive system, must be fed all the essential amino acids. Since no single feed contains all the proteins, several sources of protein should be provided for this class of animals.

FIGURE 1. *The bone perforation due to anemia. Anemia is associated with a deficiency of iron. (Courtesy University of Illinois.)*



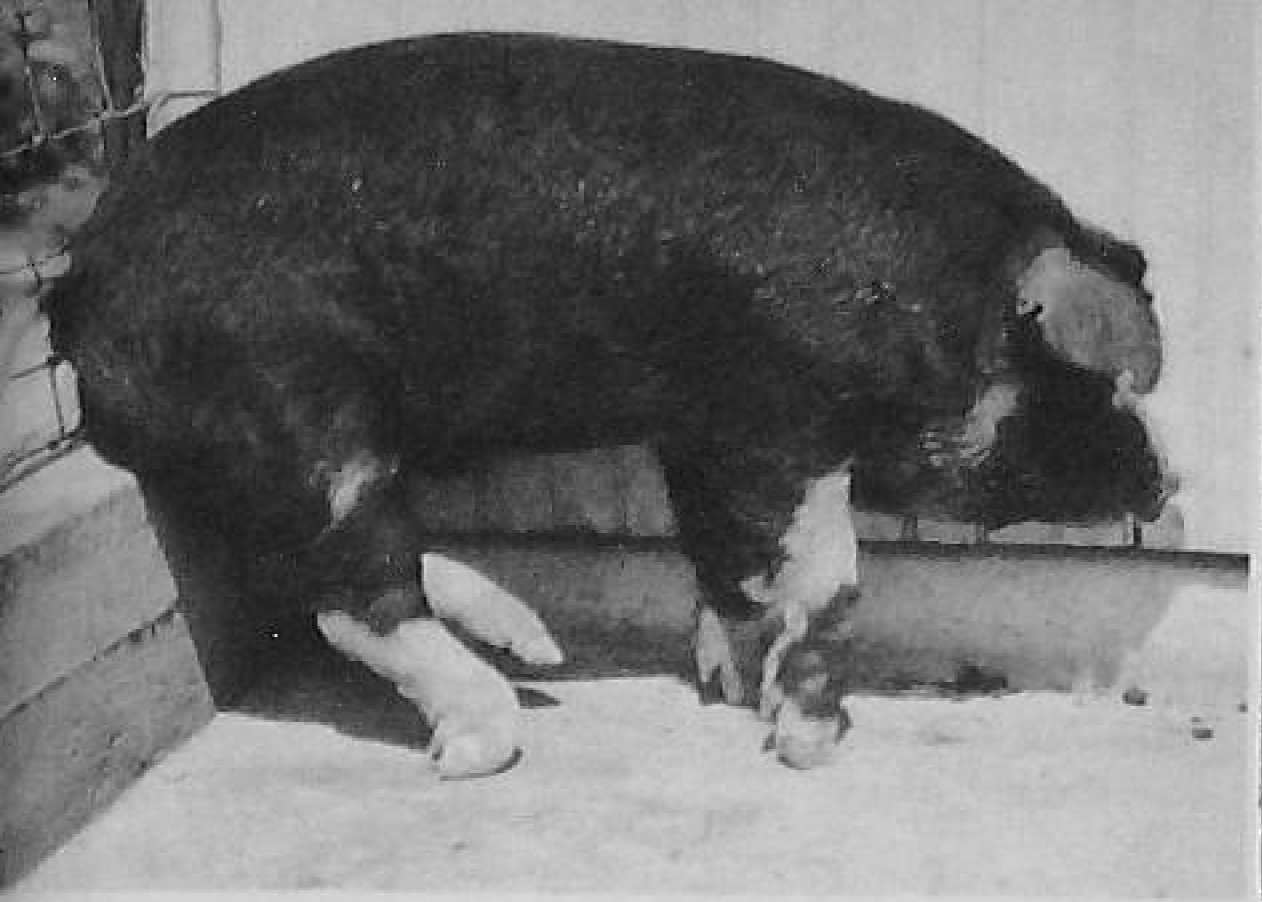


FIGURE 2. *(left) This pig was fed a ration deficient in calcium. Note the bone weakness. (Courtesy U.S.D.A. Bureau of Animal Industry.)*
FIGURE 3. *(right) The result of a ration low in vitamin A. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

Function of minerals. Minerals are needed in nearly all parts of the body but are used primarily in the bones and in the teeth. Minerals make up an important part of the blood. Even the heart depends upon mineral balance to maintain its regular beating. Many disease conditions in livestock, such as anemia, digestive trouble, and some types of paralysis, can be traced to a lack of one or more of the needed minerals.

Essential minerals. Minerals are generally divided into two groups, major minerals and trace minerals. The major minerals, salt, calcium, and phosphorus, are needed in the greatest quantity and are most likely to be lacking in the feed supplied. The trace minerals are those needed in very small amounts and yet are essential to the health of the animal. They include iron, copper, manganese, iodine, cobalt, sulphur, magnesium, zinc, potassium, and boron.

Vitamins. All the vitamins are essential in animal feeding. They are vitamin A, B complex, B_{12}, C, D, E, and K. The B complex group includes: thiamine, riboflavin, niacin, pyrodoxin, pantothenic acid, choline, biotin, pyracin, tara-amino benzoic acid, inosital, and folic acid.

Vitamin functions. The purpose or function of many of these vitamins is not clear, but we do know that serious results occur when feeds are given which do not provide the necessary vitamins. If vitmain A is lacking, animals fail to reproduce, eyesight is impaired, and growth slows down. If we do not provide the B complex group, appetite fails, and disease may become a problem. B_{12} improves the protein in grains and other feeds. A lack of vitamin E may cause a failure of the reproductive system.

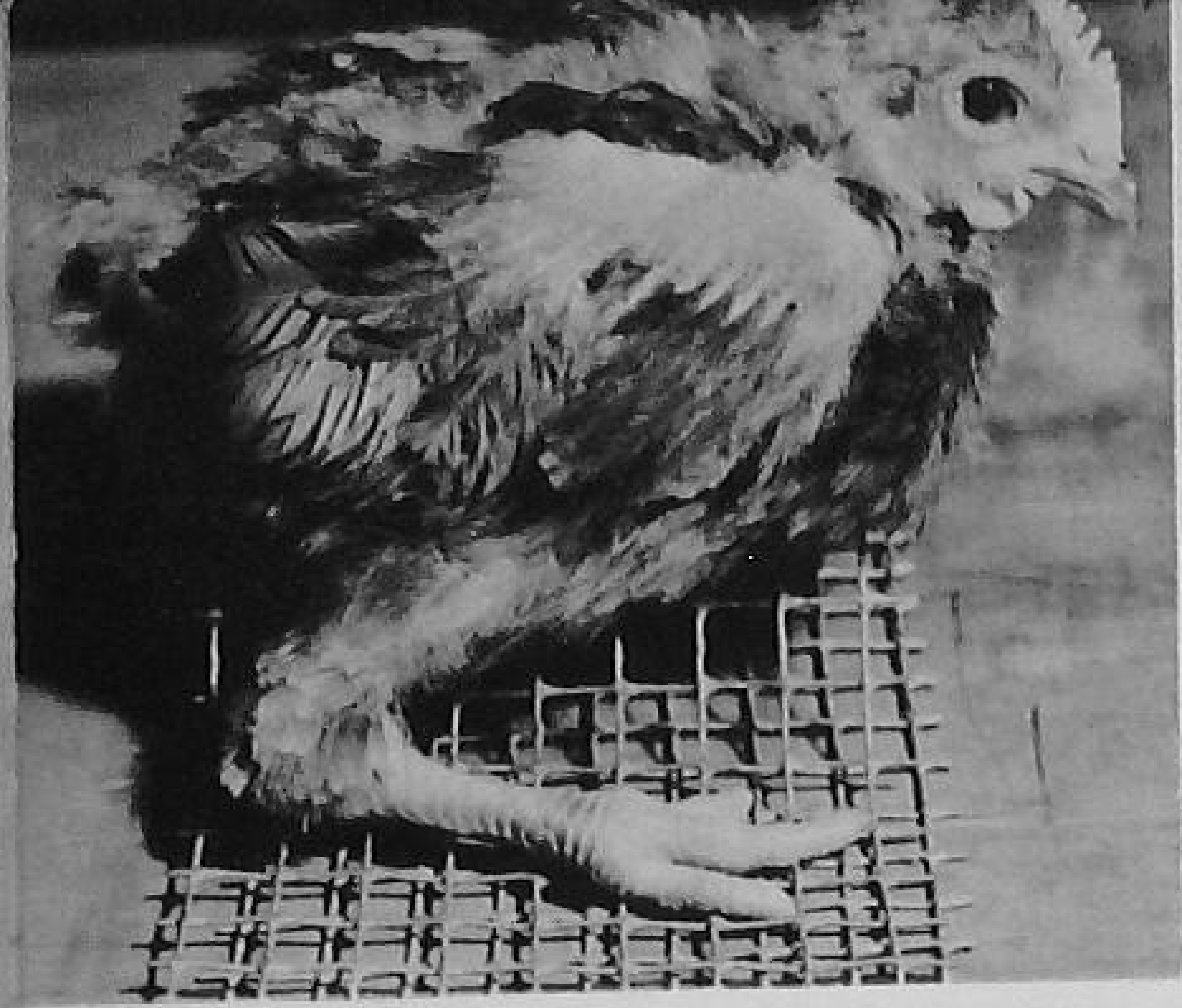


FIGURE 4. *(left) Chicken showing deficiency of riboflavin. (Courtesy Poultry Tribune.)*

FIGURE 5. *(right) Chicken showing vitamin D deficiency. (Courtesy Poultry Tribune.)*

In general we can say that vitamins provide a defense against disease, promote growth and reproduction, and contribute to the general health of the animal.

Function of water. Water is not generally considered a nutrient, but its importance to the animal cannot be overestimated. The animal body is made up of from about 45 to 70 per cent water, and nutrients must be in liquid form before they can be absorbed by the body. Water is important in controlling body temperature. In ruminants water is important in the fermentation that takes place in the animal's digestive system as part of the digestive process. Livestock must have an abundance of fresh, clean water if the best results are to be expected.

ANTIBIOTICS

In recent years we have learned a great deal about antibiotics and their value when supplied in small amounts in the daily ration of certain kinds of livestock. Antibiotics cannot be properly considered as a food nutrient but rather as a form of medication.

Function of Antibiotics. The function of antibiotics is not clear. Some authorities believe that they help control undesirable microorganisms in the digestive system and thereby increase the rate of growth. We do know that there is a generally healthier condition and an increased growth rate in most animals when they are fed daily small amounts of certain beneficial antibiotics. The known antibiotics that have shown value when fed are aureomycin, terramycin, bacitracin, and penicillin. The use of these antibiotics and the amounts fed will be discussed in the following chapters.

DIGESTIBLE NUTRIENTS

Nearly all feeds contain a certain percentage of material that is not digestible in the animal body. The nondigestible portions are eliminated by the animal as waste. The parts which are absorbed by the body are referred to as *digestible nutrients.*

Fiber. The portion of carbohydrates not easily digested is known as *fiber* or *crude fiber.* The amount of fiber which a feed contains is important in determining its value. The kind of livestock fed determines to some extent the digestibility of a feed. Ruminants can digest larger portions of fiber than can simple-stomach animals. Hays and fodders contain relatively large amounts of fiber, and are usually fed in greater amounts to cattle and sheep than they are to swine or poultry.

Nitrogen-free Extract. The term *nitrogen-free extract* often appears on the label listing the ingredients of a feed. It refers to the more digestible part of the carbohydrates rather than to the fiber, which is much less digestible.

BALANCED RATIONS

A ration is the amount of feed which is given to an animal during a twenty-four-hour period. A balanced ration is one which supplies in their correct proportion all the food nutrients necessary to properly nourish the animal during a twenty-four-hour period. The amount of the various nutrients required to balance a ration is determined by the kind of animal and the purpose for which the animal is kept. Thus, the needs of the dairy cow differ from those of the beef cow much as the needs of the brood sow and the growing pig differ.

SUMMARY

In summarizing the various food nutrients and their functions in the animal body, let us compare the animal with the modern farm tractor. The tractor has a chassis or framework, which might be termed the *skeleton.* Just as the chassis of the tractor is made from certain kinds of iron and steel, so the skeleton of an animal is made up largely of a certain material, namely, mineral. The moving parts of the tractor and the engine proper are comparable to the muscles and the internal organs of the animal. Here again, a certain material is needed in the manufacture of these parts just as proteins are needed in the animal body.

Before the engine can move, it must be fed energy. Gasoline or fuel oil furnishes energy, as do the carbohydrates and fats fed to livestock.

The tractor needs oil and grease to lessen wear, prevent breakdown, and make the parts run smoothly. The amount is small, but without it the machine becomes a stationary mass. The vitamins and antibiotics have a similar purpose in the animal body. Last of all, water is used, as in an engine, to regulate temperature.

In order for the machine to continue to run, a mechanic must be on the job replacing worn parts. In the animal the blood can be thought of as a mechanic carrying materials to various parts so that they may continue to function.

If any parts become worn and are not replaced or if the wrong kind of fuel is fed to the motor, the machine slows down, fails to run smoothly, or stops. If livestock is not fed the kind of material necessary for proper body function, it, too, slows down or stops production.

QUESTIONS

1. What is meant by the term *nutrient?*
2. List the classes of nutrients.
3. What is the main function of each nutrient class?
4. How do fats and carbohydrates differ in their ability to produce energy and fatty tissue?
5. What are the major minerals?
6. Why are trace minerals so-called?
7. Why is an abundance of clean, fresh water important to livestock production?
8. Why have antibiotics become important in certain livestock feeds?
9. What is meant by *digestible nutrient?*
10. Why does the amount of fiber reduce the digestibility of a feed?
11. To what part of a feed does the term *nitrogen-free extract* refer?
12. What is the difference between a ration and a balanced ration?

REFERENCES

Anderson, Arthur L., *Introductory Animal Husbandry*, The Macmillan Company, New York, 1948.

Morrison, Frank B., *Feeds and Feeding*, The Morrison Publishing Company, Ithaca, New York, 1948.

U. S. Department of Agriculture, *Better Feeding of Livestock*, Farmers' Bulletin No. 2052, 1952.

< 2 >

Composition and Classification of Feeds

Livestock feeds are generally classified according to the amount of total digestible nutrients they provide, or according to the amount of a specific nutrient they furnish in the ration. They are usually divided into two general classes–roughages and concentrates.

ROUGHAGES

Feeds containing relatively large amounts of fiber or nondigestible material are called *roughages.* This group of feeds includes: hays, silage, fodder, and other similar feeds.

Legume Roughages. Legumes are plants that have the ability to use nitrogen, which they take from the air. Legumes are higher in nitrogen than are other plants, and since nitrogen is essential in the manufacture of proteins, legumes are higher in protein than are other roughages. The common legumes are alfalfa, all the clovers, trefoil, soybeans, lespedeza, various kinds of peas, beans, and a large number of other less widely grown plants.

Nonlegume Roughages. Nonlegume roughages as a class are lower in protein. When they are fed as the only roughage, they seldom provide enough protein to meet the needs of the animal. The use of nonlegume roughages generally calls for an increased amount in the protein concentrates fed to balance the ration. The common nonlegume roughages are brome grass, timothy, bluegrass, prairie grass, corn fodder, corn silage, and fodder or silage made from the various sorghums.

CONCENTRATES

Concentrates are feeds which have a comparatively high digestibility. They are relatively low in fiber and include all grains and many by-products of grains and animals, such as wheat middlings, tankage, and soybean oil meal.

Protein Concentrates. Protein concentrates may be classed as a subdivision of concentrates; they refer to that group of concentrates which furnish a relatively high percentage of protein. The exact percentage of protein which a feed must contain before it may be considered a protein concentrate has not been definitely defined; but since most grains and roughages contain less than 20 per cent protein, we can consider any feed which contains 20 per cent or more a protein concentrate. Such feeds are mixed with farm-produced grains and roughages to increase the protein content of the ration. Protein concentrates are generally classified as animal or vegetable proteins.

Animal proteins. Proteins that are derived from animals or animal by-products, such as tankage, meat scraps, fish meal, dried skim milk, or dried buttermilk, are called animal proteins.

In addition to probably containing amino acids not found in other proteins, animal proteins also contain growth factors, not fully understood at this time, which make them especially valuable in the feeding of swine and poultry. Cattle and sheep, due to the type of their digestive systems, are able to manufacture some amino acids that simple-stomach animals must get from animal proteins. For this reason, and because of their expense, animal proteins are not generally considered important in the rations of cattle and sheep.

Vegetable proteins. Vegetable proteins are those found in plants or in the by-products of plants. The chief vegetable protein concentrates are soybean oil meal, linseed oil meal, cottonseed meal, and peanut oil meal.

The plant or vegetable proteins, as a class, are not nearly as complete nor as high in quality as are the animal proteins, but in the feeding of ruminants they provide the essential amino acids. In swine or poultry rations, one or more animal proteins are generally considered necessary in order to give the amino acid balance essential for best results.

SOURCES OF CARBOHYDRATES

Of the common feeds which are fed to livestock, the grains provide the best source of energy and have the highest fattening value. Among the grains used extensively for feed are corn, oats, and barley. Rye, wheat, and sorghum grains are used to some extent in certain areas of the United States.

Grains. *Corn.* Yellow corn is one of the best feed grains for

all classes of livestock. It ranks high in total digestible nutrients (about 80 per cent for No. 2 grade), low in fiber, and higher in fat than any cereal grain except oats. Corn is very palatable to all classes of livestock.

Although corn ranks high among livestock feeds, it has deficiencies which must be corrected by the use of other feeds. Protein and mineral deficiencies are the most pronounced.

Oats. As a livestock feed, oats rank second in popularity to corn. They have about the same general nutritional value as corn but contain more fiber and are less digestible. (Oats average about 70 per cent digestible as compared to 80 per cent for corn.) Their protein content is a little higher than that of corn but, like corn, is lacking in quality. In general, oats have about the same deficiencies as corn.

The fiber content is largely in the hulls and for this reason the number of hulls determines the food value of the oats. Oats grown under certain weather conditions and certain varieties of oats may contain a very large proportion of hulls; those which have had the hulls removed by mechanical means or hull-less oats have a food value equal to, or higher than, corn.

Barley. Barley is a very good substitute for corn, and can be fed successfully to all classes of livestock. Like corn and oats, it is high in nitrogen-free extract or carbohydrates. It is less digestible than corn and has more fiber, but has the advantage of containing more protein.

Barley is higher in food value per hundred pounds than oats, and in general is considered better than oats as a fattening feed. In parts of the United States a disease known as *scab of barley* has been serious. Barley infected with scab cannot be fed to swine but can be utilized by cattle. Swine will not eat barley infected with scab unless there is no other feed available. When they are forced to consume scabby barley, digestive troubles often develop.

Wheat. Wheat resembles the other cereal grains in nutritional value, having a higher carbohydrate content and a higher protein content than does corn. There is considerable variation in the food value of wheat, depending upon the variety and the locality in which it is grown.

Wheat is a very good substitute for corn, and if the price is in line, it can be used to replace a large part of the corn fed to all classes of livestock.

Rye. Because rye has about the same general food value as

other grains, it would seem a good substitute for them. However, rye is not palatable to livestock and, when fed in large quantities, may cause digestive trouble. It should be mixed with other grains and fed only as a part of the ration.

Grain sorghums. Grain sorghums resemble corn in all respects, except that they are lower in fat. The sorghums make very good livestock feed, and are well liked by all classes of stock. Sorghum grain is rather hard, and grinding is necessary if it is to be fully digested.

Molasses. Molasses has a fairly high nitrogen-free extract content, but as a livestock feed it is valued chiefly for its palatability. Molasses is generally used as a supplement to other feeds in order to increase consumption. Livestock, particularly beef cattle which are being fattened, can be induced to consume more feed if molasses is mixed with the ration, and the fattening process may be speeded up.

Poor or unpalatable roughages, such as corncobs, can be made more appetizing by the use of molasses.

Roughages as a Source of Carbohydrates. Roughages provide a relatively cheap source of carbohydrates, and good quality roughages, such as those produced by legumes or corn silage, will often provide enough carbohydrates for stock cattle or matured sheep without any other carbohydrate feeds being supplied. However, in fattening livestock the digestibility of roughages is too low to produce finished animals unless the ration is supplemented with grains.

The kind of roughage, the method of harvesting, and the stage of maturity at the time of cutting are very important factors influencing food value. Legumes and grasses cut at a late stage of maturity may not have more than half the value per ton of those cut at the proper time. As an example, alfalfa cut when only a very few flowers are showing will contain from 15 to 20 per cent more total digestible nutrients and from 25 to 30 per cent more proteins than will alfalfa cut after it reaches full bloom.

In the case of grain crops cut for silage, the grain should be reasonably mature for highest food value. Grain silage should be cut just as the lower leaves begin to dry out.

SOURCES OF ANIMAL PROTEINS

It has been pointed out earlier in the chapter that animal protein

feeds come from animal by-products, dairy products, and from dairy by-products.

Animal By-products. *Tankage and meat scraps.* Tankage and meat scraps are very much alike in composition. Both are by-products of packing houses or rendering plants. The digestible protein content will vary considerably, depending upon the contents of the feed. If the product contains a large percentage of hair or gristle, the total protein content may be high, but the digestible protein content may be relatively low.

Since it is impossible for the user to determine what amount of nondigestible protein a feed contains, it is wise to buy only from a company known to be reliable.

Meat and bone scraps. The combination of meat and bone scraps contains a higher percentage of bone. Since bone is lower in protein than are meat scraps, the total protein content of the feed is generally lower.

In the manufacture of all animal products that go into livestock feed, the material is heated to prevent the carrying of disease.

Blood meal. Blood meal is made from the blood collected at the packing houses. In the manufacturing process, the material is heated and dried. Blood meal is high in total protein, but its quality and digestibility are lower than that of good grade tankage or meat scraps.

Fish meal. Fish meal is manufactured either from the waste material of the fish industry or from fish not considered good for human consumption.

Fish meal is one of the best feeds for swine and poultry because of its high percentage of good quality protein. As in tankage and meat scraps, the protein content varies, depending upon the materials used and the methods of manufacture.

Dairy Products and By-products. *Skim milk and buttermilk.* Both of these products contain over 90 per cent water, but the dry matter is about one-third protein. Nearly all the protein is digestible, and when these products are available, they furnish one of the best sources of protein.

Dried skim milk and buttermilk. A heating process drives off most of the water in skim milk and buttermilk, leaving the milk solids in a dry condition. These dried milk solids furnish a high protein food of good quality.

SOURCES OF VEGETABLE PROTEIN

All seeds, roughages, and grain by-products furnish various amounts of proteins, but the chief sources of vegetable proteins are the seed by-products and legume roughages.

Seed By-products. *Soybean oil meal.* Soybean oil meal is the residue left from soybeans after the oil has been removed. The residue is ground or formed into pellets and marketed as livestock feed.

Soybean oil meal varies in protein content from 41 to 46 per cent, depending upon the method of manufacture. The protein is of very high quality, and may be used to furnish a major part of the protein concentrate in rations for most livestock.

Soybeans. Soybeans have the highest protein content of any seeds commonly used for feed. Soybeans will average about 37 per cent total protein, but the quality is low. The protein in soybeans is improved by the heating process used in the manufacture of soybean oil meal. This explains the high-quality protein found in the meal as compared to that in the raw soybeans.

If their price is low in comparison with the price of other forms of vegetable proteins, ground soybeans may be used to furnish a part of the protein in rations for cattle and older swine.

Cottonseed meal and cake. When cotton is processed, the seed is removed from the lint and the oil is extracted from the seed. The seed residue is manufactured into meal or cake and sold as a protein concentrate.

The protein content of cottonseed meal varies from 38 to 47 per cent, depending upon the variety of cotton from which the seed is taken and upon the method of processing. Cottonseed meal is a good source of protein for ruminants, but it should be used in limited amounts as a protein concentrate for nonruminants.

Linseed meal. When flax seed is processed, the oil is removed from the seed and the residue is made into livestock feed. The oil is known as *linseed oil*, and the meal as *linseed oil meal*. Linseed oil meal is one of the most widely used protein feeds. Its protein content ranges from 31 to 36 per cent, and it may be successfully used as the only protein feed for cattle and sheep. For swine and poultry, linseed meal should be used as only a part of the protein concentrate in the ration.

Peanut oil meal. Peanut oil meal is the residue of the peanut from which the oil has been removed. Peanut oil meal can be

used as protein feed for all classes of livestock but, it is generally preferred as a swine or dairy cattle feed. When fed as the only protein, it may be too laxative. Best results are obtained when peanut oil meal is used in combination with other proteins.

Corn gluten meal. Corn gluten meal is a by-product of corn used in the manufacture of corn oil and corn starch. The protein content ranges from 40 to 44 per cent. Corn gluten meal may be used as a part of the protein in livestock rations. The quality of protein is not high, and best results are obtained when it is fed in combination with other proteins.

Legume Roughages. Legumes, when fed as dry roughages, silage, or pasture, furnish an excellent source of high-quality protein. Under some conditions legumes will furnish all the needed protein. Stock cattle may be successfully wintered on legume forage without any other protein feeds being provided. Legumes furnish a cheap source of protein, and when legume forage is used in the ration, the amount of protein concentrates may be reduced without affecting the growth or production of the livestock.

SOURCES OF VITAMINS

Livestock, when fed a well-balanced ration consisting of grains, protein concentrates, and good forage, generally gets enough of the needed vitamins. However, under certain conditions, which will be discussed in later chapters, it may be necessary to select feeds high in essential vitamins. Vitamins most likely to be deficient in the feed are A or carotene, the B complex group, D, and E.

Vitamin A. *Vitamin A in forage.* Vitamin A is found in plants and in plant products as carotene, which is converted into vitamin A in the digestive system of animals. Green plants have an abundance of carotene, and there is seldom any need to give any special attention to the vitamin A content of a ration for livestock on pasture.

When forage crops are harvested, a large part of the carotene may be lost unless special care is taken to preserve it. Roughages that retain their green color and most of the leaves when cured will still be high in carotene content. Very little carotene is lost when roughages are converted into silage. Legume and grass crops harvested during the natural growing period and in good weather have a much higher carotene content than do mature or

badly weathered forages. Forages lose much of their carotene content when kept in storage for long periods of time.

Vitamin A in grains. Carotene is found in yellow corn and is an important source of vitamin A. Legume forages, however, contain a much higher percentage of this vitamin than does corn.

Commercial sources of vitamin A. The fish liver oils are one of the best sources of concentrated amounts of vitamin A. Cod liver oil is often used as a vitamin A supplement for small pigs and chickens not on pasture. For feed-mixing purposes vitamin A may also be purchased in a supplement containing a mixture of several other vitamins.

Vitamin B. *Vitamin B complex group in forages.* With the exception of vitamin B_{12}, which will be discussed separately, forages provide an excellent source of the B complex group of vitamins.

Vitamin B complex group in animal products. The animal products, especially milk or milk products, furnish substantial amounts of vitamin B complex when included in livestock rations.

Vitamin B complex group in grains. Grain crops provide, to some extent, most of the B vitamins, but they are not high enough in these essential vitamins to be relied upon entirely. Unless a good forage is fed, some other source of the B group should be included in the ration.

Vitamin B group in brewers' yeast and distillers' solubles. When there is a need for more of the B vitamins than those supplied by the ration being fed, small amounts of yeast or distillers' solubles are often used to boost the B content of the ration.

B_{12} in animal products. Although vitamin B_{12} is included in the B complex group, it is found in a limited number of feeds; for this reason it is discussed separately. With the exception of commercial sources, B_{12} is found only in animal products, such as milk, tankage, meat scraps, fish meal, and similar feeds.

Ruminants manufacture B_{12} during the process of digestion, and with the possible exception of very young ruminants, it does not have to be supplied in their feed. Swine following cattle are supplied B_{12} to some extent through the feces of the cattle.

B_{12} is one of the important ingredients in animal proteins necessary for growth in poultry and swine. When B_{12} is supplied in other forms, the amount of animal protein fed swine and poultry can be considerably reduced without affecting the growth rate of the animal.

Commercial sources of vitamin B_{12}. Many laboratories and feed companies manufacture concentrated forms of vitamin B_{12}, which may be purchased for feed-mixing purposes.

Vitamin D. *Vitamin D in sunlight.* Vitamin D is often called the *sunshine vitamin*, and animals exposed to direct sunlight seldom suffer from a vitamin D deficiency. However, animals that are kept inside, especially young pigs and chickens, must have special attention given to the D content of their ration.

Vitamin D in forage crops. Forage crops, especially sun-cured legume hays, are very good sources of vitamin D. The D vitamin is absorbed by the legume during curing.

Commercial sources of vitamin D. Concentrated amounts of vitamin D may be secured in fish liver oils and irradiated yeast. These two materials are the best supplements to a ration low in vitamin D.

Vitamin E. *Vitamin E in farm feeds.* Vitamin E is found in nearly all forages, feed grains, and protein concentrates. Animals fed a reasonably well-balanced ration seldom need additional amounts of this vitamin.

Vitamin E is essential for fertility. Bulls and other male animals used heavily in breeding programs may show some benefit from additional amounts of vitamin E.

Wheat germ oil as a source of vitamin E. When amounts of vitamin E greater than those supplied by the ordinary ration are desired, wheat germ oil is usually considered the best source. Wheat germ oil is manufactured commercially and can be purchased through most feed dealers.

SOURCES OF MINERALS

Several minerals are needed in well-balanced livestock rations. Most of the essential minerals are present in common livestock feeds, but the amounts are generally not great enough to provide for the mineral needs of farm livestock. Therefore, mineral supplements are generally recommended.

Minerals in Farm-produced Feeds. All farm-grown feeds contain minerals, but the legume forages are the best sources. Legumes are high in both phosphorus and calcium. The mineral content of all farm-grown feeds depends upon the soil on which they are grown. Legumes grown on well-limed and phosphated soils have a higher content of these important minerals than do those grown on acid and low-phosphorus soils.

The trace mineral content of grains and roughages depends largely upon the types of soil on which they were grown. The presence or absence of trace minerals in the soil may not necessarily affect the yield of the crop, but it does affect the value of the feed from a mineral standpoint.

Minerals in Protein Concentrates. Animal protein feeds, especially meat and bone scraps, tankage, and fish meal, are excellent sources of minerals. The mineral content in these feeds varies from 15 to 25 per cent, and the necessity for other mineral supplements is reduced when such feeds are used in the ration. Since all protein feeds are relatively high in price, they are fed primarily for their protein content. The amount fed is seldom enough to meet the mineral needs of the animal.

Vegetable protein meals are much lower in mineral content than are the animal proteins, but higher than are the farm grains.

Chief Sources of Mineral Supplements. High-quality ground limestone is one of the best sources of calcium for mixing mineral supplements. Limestone is cheap and available in most areas.

Steamed bone meal, which is manufactured by cooking clean bones under steam pressure, is the most common phosphorus supplement. It is also a very good source of calcium.

Salt is needed by all livestock and is easily obtainable either in loose or block form. Mineralized salt, which contains a mixture of trace minerals, is also available.

Trace minerals can best be secured by purchasing what is commonly known as *trace mineral mixture*. This mixture contains the trace minerals in proper proportion, and can be mixed with limestone, salt, and bone meal to make up a complete mineral mixture.

SOURCES OF ANTIBIOTICS

Recent experiments have shown that antibiotics are very important for promoting growth in certain types of livestock, particularly swine and poultry. No farm-produced feeds contain antibiotics; therefore, we must rely upon commercially mixed feeds or antibiotic concentrates for supplementing rations with these important substances.

When we mix our own feeds, an antibiotic-vitamin supplement may be purchased and mixed in the ration according to the manufacturer's directions. According to Dr. Damon Catron, swine nutritionist at Iowa State College, antibiotic vitamin pre-mix should

TABLE 1

Average Composition of Common Concentrates High in Energy and Fat-Producing Value *
(Expressed in Per Cent)

Feed	*Total Dry Matter*	*Total Digestible Nutrients*	*Total Protein*	*Digestible Protein*	*N-free Extracts or Carbohydrates*	*Fat*	*Mineral Matter*	*Fiber*
Barley	89.4	77.7	12.7	10.0	66.6	1.9	2.8	5.4
Beet pulp (dried)	90.1	67.8	9.2	4.3	57.2	0.5	3.4	19.8
Corn (No. 2)	85.0	80.1	8.6	6.6	69.3	3.9	1.2	2.0
Ground ear corn	86.1	73.2	7.3	5.3	66.3	3.2	1.3	8.0
Feterita (grain)	89.4	79.8	12.2	9.5	70.1	3.2	1.7	2.2
Kafir (grain)	89.8	81.6	10.9	8.8	72.7	2.9	1.6	1.7
Milo (grain)	89.4	80.1	11.3	8.8	71.3	2.9	1.7	2.2
Blackstrap molasses	74.0	54.0	2.9	0	62.1	0	9.0	0
Oats (hulled)	90.4	92.0	16.3	14.7	63.7	6.1	2.2	2.1
Oats	90.2	70.1	12.0	9.4	58.6	4.6	4.0	11.0
Rye	89.5	76.1	12.6	10.0	70.9	1.7	1.9	2.4
Wheat	89.5	80.0	13.2	11.1	69.9	1.9	1.9	2.6
Wheat bran	90.1	67.2	16.9	13.7	52.9	4.6	6.1	9.6
Wheat middlings	89.2	78.9	18.3	16.1	59.8	4.2	3.1	3.8

TABLE 2

Average Composition of Common Protein Concentrates *
(Expressed in Per Cent)

Feed	*Total Dry Matter*	*Total Digestible Nutrients*	*Total Protein*	*Digestible Protein*	*N-free Extracts or Carbohydrates*	*Fat*	*Mineral Matter*	*Fiber*
Blood meal	91.8	61.3	84.5	60.0	0.7	1.1	4.5	1.0
Buttermilk (dried)	92.4	84.0	32.4	29.2	43.3	6.4	10.0	0.3
Corn gluten meal	91.4	80.2	42.9	36.5	40.1	2.0	2.5	3.9
Cottonseed meal	92.7	75.8	43.9	32.8	26.3	7.1	6.4	9.0
Fish meal	92.9	72.8	63.9	56.2	4.0	6.8	17.6	0.6
Linseed meal	91.0	77.2	35.4	30.8	36.0	5.8	5.6	8.2
Meat scraps	93.9	66.6	55.8	45.8	1.3	9.3	25.4	2.1
Meat & bone scraps	94.5	65.2	46.3	38.0	2.3	12.0	31.9	2.0
Milk (dried-skim)	94.0	80.7	34.7	31.2	50.3	1.2	7.8	0.2
Peanut oil meal	93.0	82.4	43.5	39.6	23.4	7.6	5.2	13.3
Soybean seed	90.0	87.6	37.9	33.7	24.5	18.0	4.6	5.0
Soybean oil meal	91.3	78.9	45.4	38.1	29.3	5.3	5.9	5.4
Tankage (high-grade)	93.1	68.4	60.6	51.5	1.8	8.5	20.2	2.0

* Adapted by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*, 21st edition, by F. B. Morrison.

TABLE 3

AVERAGE COMPOSITION OF COMMON DRY ROUGHAGES *
(Expressed in Per Cent)

Feed	*Total Dry Matter*	*Total Digestible Nutrients*	*Total Protein*	*Digestible Protein*	*N-free Extracts or Carbohydrates*	*Fat*	*Mineral Matter*	*Fiber*
Alfalfa hay (average)	90.5	50.3	14.8	10.5	36.6	2.0	8.2	28.9
Alfalfa hay (high-grade)	90.5	52.7	17.2	12.6	39.4	2.6	8.7	22.6
Alfalfa meal (dehydrated)	93.6	54.7	18.9	13.8	38.1	2.8	9.5	24.3
Birdsfoot trefoil	90.5	51.1	13.8	9.5	41.2	2.1	5.9	27.5
Bluegrass hay	89.4	54.8	8.2	4.8	42.1	2.8	6.5	29.8
Brome grass hay	88.1	48.9	9.9	5.0	39.5	2.1	8.2	28.4
Clover hay–red (good)	88.1	53.6	11.4	6.7	40.8	2.6	6.1	27.2
Clover hay–red (second cutting)	88.1	54.6	13.4	9.1	40.4	2.9	6.9	24.5
Corncobs (ground)	90.4	45.7	2.3	0	54.0	0.4	1.6	32.1
Corn fodder, (medium water, well-eared)	82.6	53.9	6.8	3.3	46.7	2.1	5.2	21.8
Fescue hay	89.2	52.7	7.0	3.7	43.2	1.9	6.8	30.3
Hegari (fodder)	86.0	52.2	6.2	3.2	52.5	1.7	7.5	18.1
Kafir (fodder)	90.0	53.6	8.7	4.5	44.2	2.6	9.0	25.5
Lespedeza hay (annual)	89.2	47.5	12.7	6.4	42.2	2.4	5.2	26.7
Lespedeza hay (perennial)	89.0	41.4	13.2	4.4	42.7	1.7	4.9	26.5
Oat straw	89.7	44.7	4.1	0.7	41.0	2.2	6.3	36.1
Orchard grass hay	88.6	47.8	7.7	3.9	40.7	2.9	6.8	30.5
Prairie hay, Western (good)	91.7	49.6	5.7	2.1	44.9	2.3	7.4	30.4
Reed canary grass hay	91.1	45.1	7.7	4.8	44.3	2.3	7.6	29.2
Sorghum (fodder sweet)	88.8	52.4	6.2	3.3	48.1	2.4	7.1	25.0
Soybean hay (seed well developed)	88.0	52.5	15.2	10.8	35.2	4.7	6.2	26.7
Sudan grass hay	89.6	50.0	11.2	6.3	41.3	1.5	9.5	26.1
Timothy hay (good)	89.0	50.8	7.5	4.1	44.4	2.4	4.7	30.0

* Adapted by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*, 21st edition, by F. B. Morrison.

TABLE 4

AVERAGE COMPOSITION OF PASTURE LEGUMES AND GRASSES *

(Expressed in Per Cent)

Feed	*Total Dry Matter*	*Total Digestible Nutrients*	*Total Protein*	*Digestible Protein*	*N-free Extracts or Carbohydrates*	*Fat*	*Mineral Matter*	*Fiber*
Alfalfa	25.3	14.7	4.5	3.4	10.4	0.9	2.3	7.2
Bluegrass	30.2	19.2	5.5	3.9	13.4	1.2	2.5	7.6
Brome grass	25.0	15.5	5.2	3.7	10.6	0.9	2.6	5.7
Clover (Ladino)	16.3	11.4	4.4	3.7	7.1	0.4	2.2	2.2
Clover (red)	25.0	16.8	4.0	2.8	11.2	0.9	2.1	6.8
Clover (alsike)	22.2	14.5	3.8	2.7	9.7	0.6	2.3	5.8
Clover (sweet)	20.8	12.8	4.1	3.2	9.2	0.7	1.9	4.9
Fescue	30.5	18.8	3.0	1.6	14.0	1.0	2.4	10.1
Lespedeza (annual)	25.0	12.7	4.1	2.0	9.2	0.5	3.2	8.0
Rape	16.3	12.8	2.9	2.4	8.0	0.6	2.2	2.6
Timothy	23.9	15.4	4.7	3.5	11.1	0.9	2.6	4.6
Trefoil	22.7	13.3	3.4	4.5	9.5	0.8	2.3	5.6

TABLE 5

AVERAGE COMPOSITION OF COMMON KINDS OF SILAGE *

(Expressed in Per Cent)

Feed	*Total Dry Matter*	*Total Digestible Nutrients*	*Total Protein*	*Digestible Protein*	*N-free Extracts or Carbohydrates*	*Fat*	*Mineral Matter*	*Fiber*
Alfalfa	36.0	21.3	6.0	4.1	13.7	1.4	3.2	11.7
Corn	28.4	20.0	2.3	1.3	17.3	0.9	1.6	6.3
Grass-legume mixture	33.3	19.1	5.2	2.9	14.2	1.3	3.8	8.8
Grain sorghum	30.0	17.1	2.6	1.4	18.6	0.7	2.1	6.0

* Adapted by special permission of the Morrison Publishing Company, Ithaca, New York, from *Feeds and Feeding*, 21st edition, by F. B. Morrison.

contain, per pound, a minimum of the following: antibiotics, 1000 milligrams; vitamins: B_{12}, 1.0 milligrams; riboflavin, 200 milligrams; niacin, 2000 milligrams; pantothenic acid, 200 milligrams; choline, 10,000 milligrams; and vitamin D_2, 2,000,000 international units.

There is evidence that a mixture of the known beneficial antibiotics may be better than any single antibiotic; therefore, a premix that contains aureomycin, terramycin, and penicillin is often used. The addition of bacitracin may also improve the mixture.

NUTRIENT VALUES OF LIVESTOCK FEEDS

Grains and roughages vary considerably in nutrient value, depending upon their variety, the locality and type of soil in which they are grown, their stage of maturity, the methods of harvesting, and the length of time in storage. The manufacturing process determines to some extent the value of feeds. For these reasons average compositions of various feeds generally have to be used when planning livestock rations. Tables 1 through 5 give the average composition of commonly used livestock feeds.

SUMMARY

Feeds are divided into two groups: roughages and concentrates. Roughages are those feeds relatively high in fiber, such as legume and grass hays, fodders, and silages. Concentrates are the low-fiber feeds and include the grains, dairy products, and feeds manufactured from seed, dairy, and animal by-products.

Protein concentrates are feeds high in protein; they are classified as vegetable or animal proteins depending upon the material from which they are made.

The grains are higher in fattening and energy value than are other common feeds; however, roughages, although lower in nitrogen-free extract and higher in fiber, are generally a source of low-cost carbohydrates.

Tankage, meat scraps, meat and bone scraps, fish meal, milk, and milk products are all good sources of animal protein.

The vegetable proteins are supplied in soybean oil meal, linseed meal, cottonseed meal, and other feeds derived from plants. Legumes when used as feed will replace much of the protein available from other sources.

Older animals receiving rations consisting of legumes, proteins, and grains seldom need added vitamins, except possibly B_{12}. However, vitamin concentrates are often essential for best results in feeding young animals. The vitamin concentrates are found in such feeds as fish liver oil (vitamins A and D) and wheat germ oil (vitamin E). The B complex group may be purchased in a vitamin pre-mix available in most localities.

Antibiotics have an important place in livestock feeding, and are usually provided in an antibiotic and vitamin pre-mix or in commercial ready mixed feeds.

QUESTIONS

1. What are the two main classes of feeds?
2. How do roughages and concentrates differ?
3. List several common roughages.
4. Why are legumes higher in protein than are other roughages?
5. Name some common legumes.
6. Name some common nonlegume roughages.
7. What are some of the common feeds known as concentrates?
8. What are protein concentrates?
9. What is the chief difference between animal and vegetable proteins?
10. List the feeds commonly fed for their carbohydrate content.
11. List some of the common animal protein feeds.
12. What are some popular vegetable protein feeds?
13. What vitamins are most likely to be lacking in livestock rations?
14. Explain how vitamins may be added to a ration when the ordinary foods fail to provide essential amounts.
15. What materials may be used in mixing a mineral supplement for livestock?
16. Give two common methods of supplying antibiotics in the ration.

REFERENCES

Anderson, Arthur L., *Introductory Animal Husbandry*, The Macmillan Company, New York, 1948.

Bohstedt, G., *Antibiotics and Vitamin B_{12} in Livestock Feeding*, University of Wisconsin, Madison, Wisconsin, Circular 392, 1951.

Morrison, Frank B., *Feeds and Feeding*, 21st edition, The Morrison Publishing Company, Ithaca, New York, 1948.

U. S. Department of Agriculture, *Better Feeding of Livestock*, Farmers' Bulletin No. 2052, 1952.

< 3 >

Digestion in Ruminants and in Simple-Stomach Animals

Some knowledge of the differences in digestive systems is necessary to understand livestock feeding and the reasons why some feeds are more valuable for one class of animals than for another.

DIGESTION IN RUMINANTS

The stomach of ruminants is divided into four compartments. These compartments are known as the *rumen*, *reticulum*, *omasum*, and *abomasum*.

Functions of the Four Compartments. *Rumen.* The rumen is the first and by far the largest compartment of the stomach. It serves as a storage area for large quantities of feed, especially roughages, and has a capacity of from 40 to 60 gallons in mature cattle, depending upon the size of the animal.

During the process of eating, ruminants chew their food just enough to make swallowing possible. While the food is in the rumen, it is worked upon by millions of bacteria and other microorganisms. These microorganisms are able to transform low-quality proteins and nitrogen compounds into essential amino acids or high-quality proteins. They also manufacture many needed vitamins. The proteins and vitamins are used by the bacteria before they themselves are digested by the animal later in the digestive process.

After the ruminants have consumed their feed, regurgitation or chewing the cud takes place. The food is brought up from the rumen and the chewing completed. It is then swallowed again, returning to the rumen for further bacterial action.

The presence of the rumen, and the bacterial action which takes place in it, explains why ruminants can digest large quantities of

fiber, converting it into meat, wool, and dairy products; for this reason, too, the B complex vitamins and animal protein are seldom necessary in their ration. In young animals the rumen is not developed, and during the period of milk feeding care must be taken to see that a proper balance of vitamins and proteins is provided.

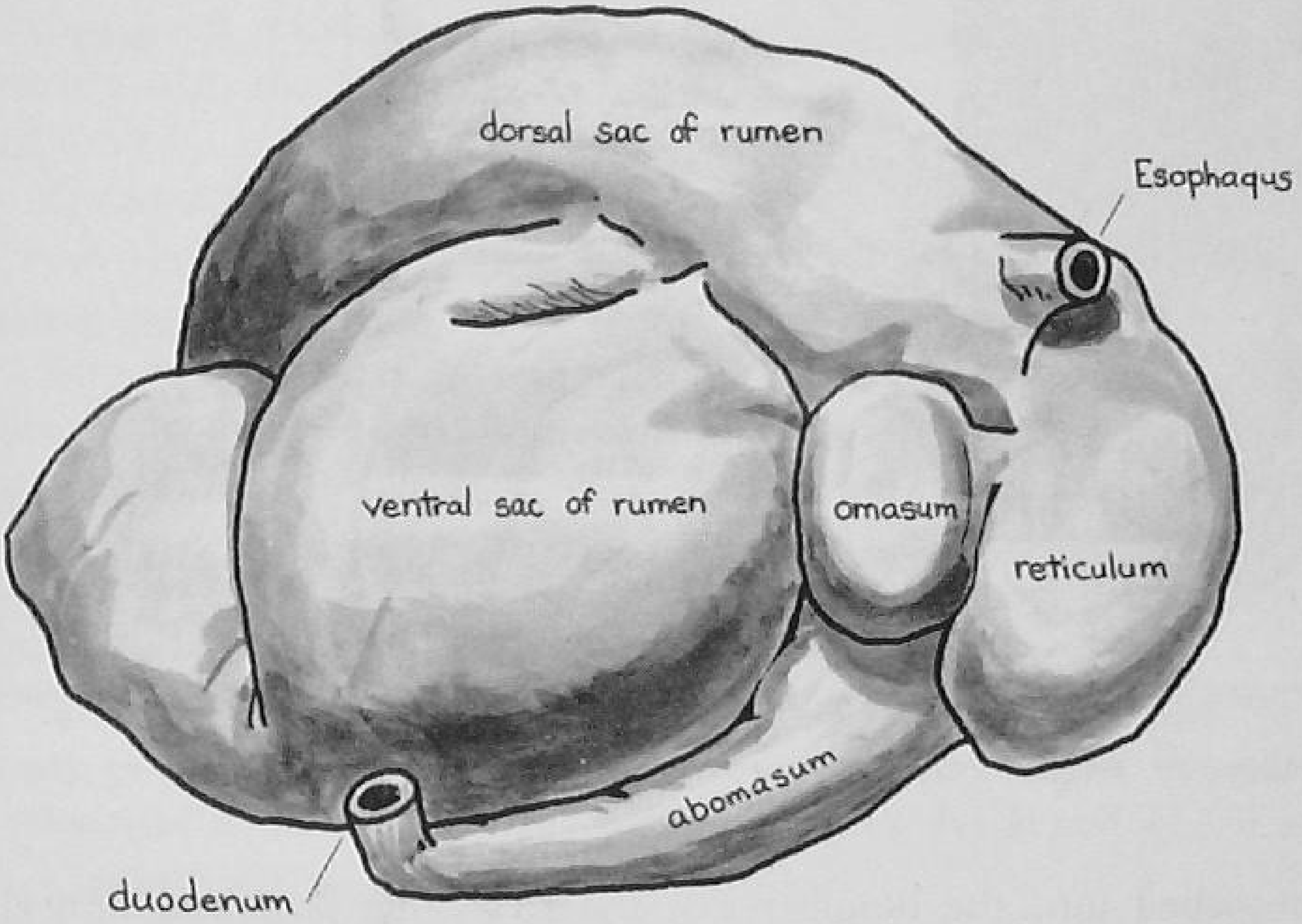
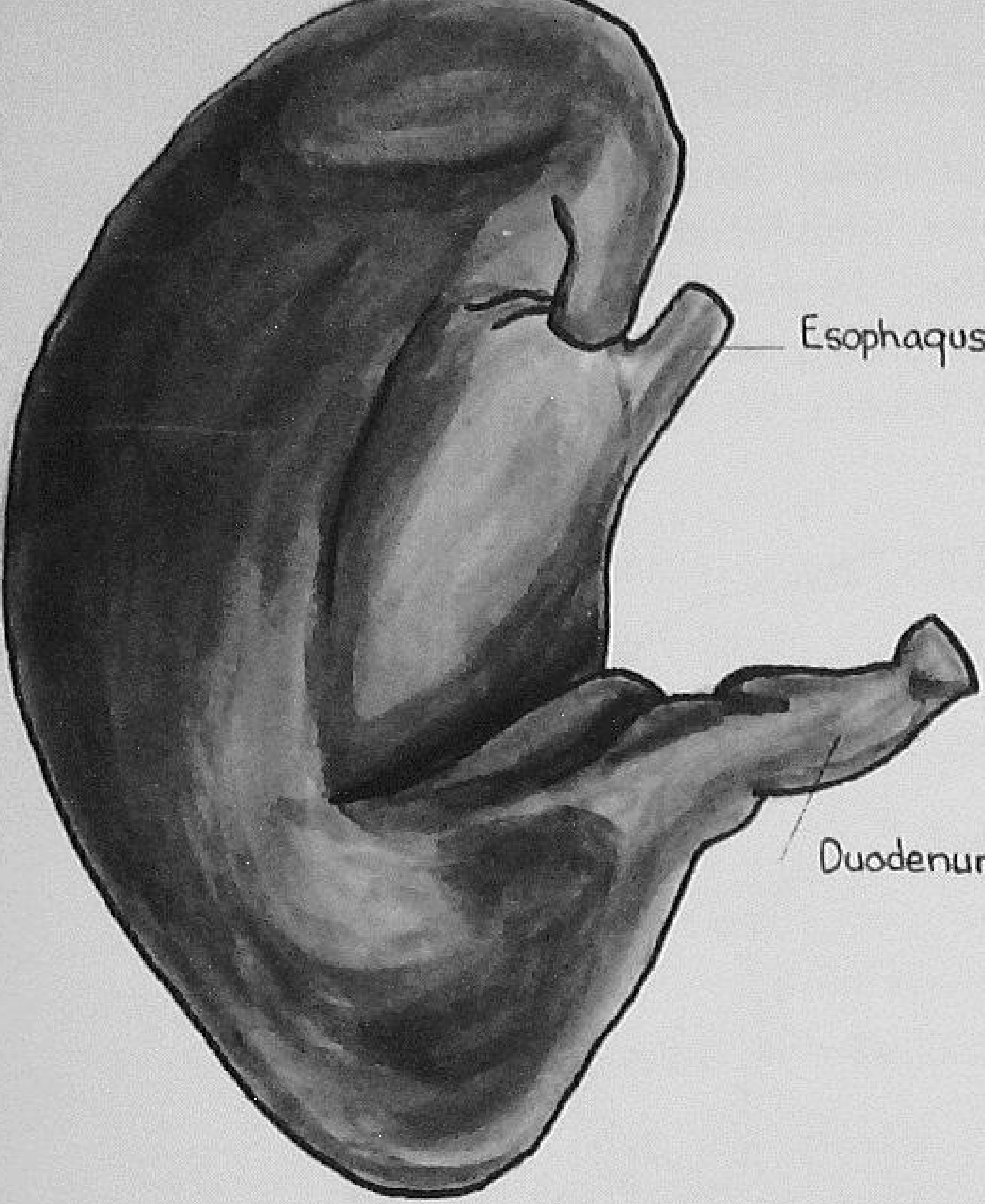


FIGURE 6. *The stomach of a sheep showing the four compartments. (Drawing by Harlan Clark.)*

Reticulum. The reticulum is closely associated with the rumen, and it is here that many foreign bodies, such as wire and nails, are retained. If these objects are not pointed nor too sharp, they may be held in the reticulum for long periods without any serious damage.

Omasum. The omasum, or third compartment of the stomach, consists of strong muscular walls. Its chief function seems to be that of squeezing out the water from the feed before it enters the abomasum or true stomach.

Abomasum. The abomasum is the fourth compartment or true stomach. Its functions are similar to those of the simple stomach in swine. Gastric juice, which is necessary in protein digestion, is secreted in the abomasum. When the food leaves the abomasum, it goes into the small intestines where the digestible portion is



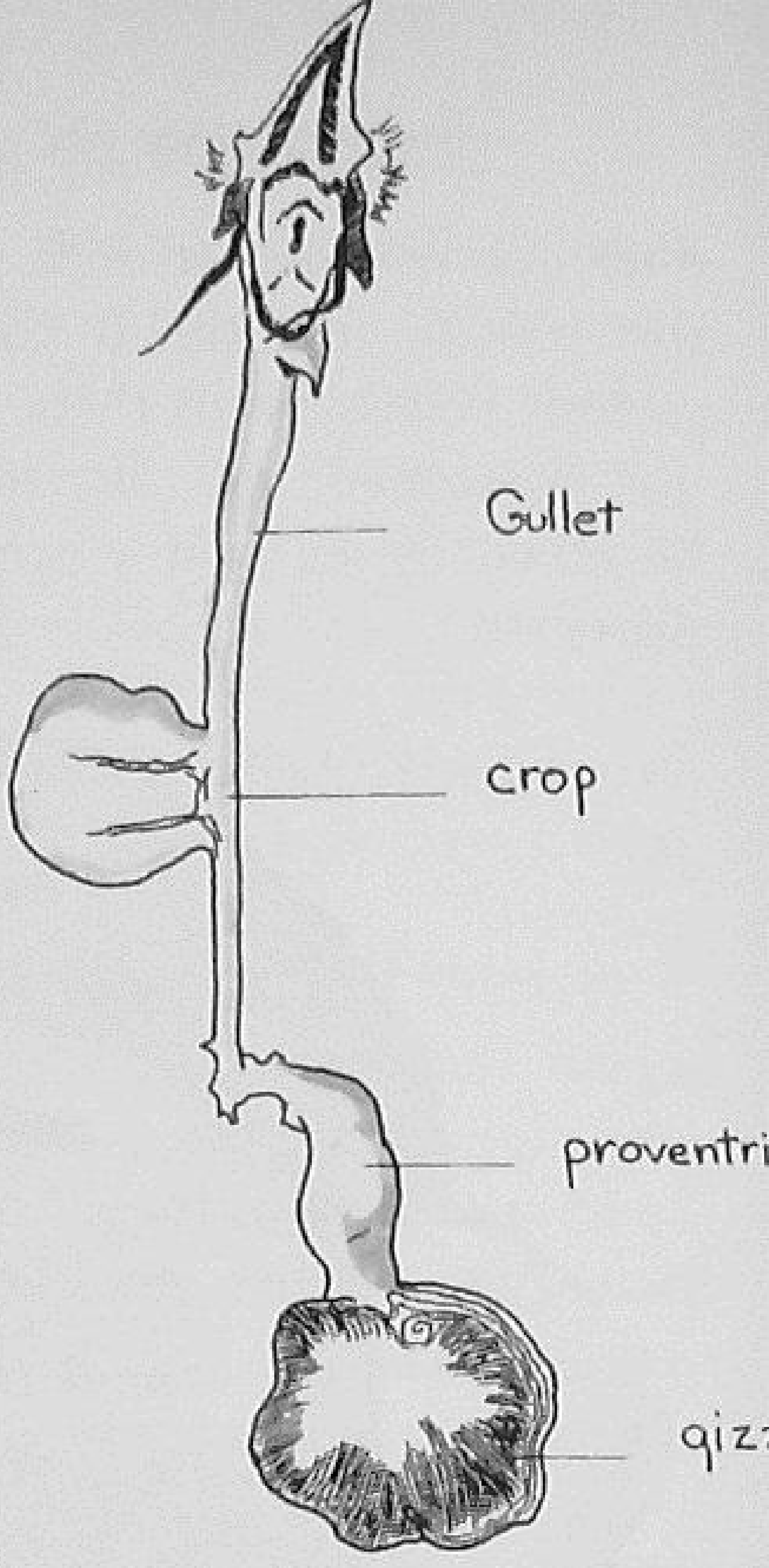


FIGURE 7. *(left) The stomach of a pig. Note the single compartment. (Drawing by Harlan Clark.)*
FIGURE 8. *(right) Principal digestive organs of poultry. (Drawing by Harlan Clark.)*

absorbed into the bloodstream; the remainder is passed into the large intestines and eliminated as waste.

DIGESTION IN SIMPLE-STOMACH ANIMALS

In simple-stomach animals food is swallowed directly into the single-compartment stomach where it is mixed with the digestive juices. Very little bacterial action takes place, and there is no conversion from low-quality to high-quality proteins. Simple-stomach animals have less ability to manufacture the vitamins than do ruminants and are unable to digest large quantities of fiber. The digestive process in simple-stomach animals is very similar to that of ruminants after the food enters the abomasum.

We must give much more consideration to the protein, vitamin, and mineral content of rations fed to swine and poultry than to the content of those fed to cattle and sheep.

DIGESTION IN POULTRY

Poultry cannot be classed as a simple-stomach animal, and yet its digestive system is somewhat similar. Very little digestion

through bacterial action takes place, and poultry digests smaller amounts of fiber than does any other class of farm livestock.

Functions of the Digestive Organs. *Crop.* Food taken in through the mouth moves down the esophagus into the crop. The crop acts as a reserve to hold and moisten feed. Very little digestion takes place in this organ.

Proventriculus. The proventriculus is a small organ that receives food from the crop. Here digestive juices are secreted and mixed with the food. Food leaving the proventriculus enters the gizzard.

Gizzard. The chief function of the gizzard is to grind and crush the coarse food before it enters the small intestine, where the digestible portion is absorbed into the bloodstream.

Unlike ruminants, a ration for poultry should include all the essential protein amino acids and most of the vitamins. There is some indication that fowl may manufacture vitamins C and K. Other vitamins must be supplied.

SUMMARY

The stomachs of ruminants, such as cattle, sheep, and goats, have four compartments. The rumen is by far the largest compartment and serves as a storage place for bulky feeds and as a place for bacterial action.

Because of bacterial action, which is part of the digestive process, ruminants can digest large quantities of fiber and convert low-quality proteins into essential amino acids. The microorganisms also manufacture most of the B vitamins, which are later absorbed by the animal.

Swine and poultry have a simple digestive system and must rely directly upon the feed they consume to obtain all classes of nutrients. They have much less ability to digest fiber than do ruminants.

QUESTIONS

1. Name the four compartments in the ruminant stomach.
2. What is the principal digestive process that takes place in the rumen?
3. Explain why ruminants can convert comparatively low-quality protein feeds and a certain amount of nitrogen compounds into usable amino acids.
4. Why do we have less difficulty in supplying older ruminants with the B vitamins?

5. How do ruminants, swine, and poultry rank in their ability to digest fiber?

REFERENCES

Dykstra, R. R., *Animal Sanitation and Disease Control*, The Interstate Printers and Publishers, Danville, Illinois, 1949.

Stamm, G. W., *Veterinary Guide for Farmers*, Windsor Press, New York, 1950.

Winter, A. R., and Funk, E. M., *Poultry Science and Practice*, J. B. Lippincott Company, Philadelphia, 1951.

< 4 >

Measuring the Value of Feeds

No single method of determining the value of feeds is accurate enough for all purposes. Many factors must be considered if a reasonably correct appraisal of any feed or group of feeds is to be made.

CLASSES OF ANIMALS AFFECT FEED VALUE

The kind of livestock fed is important in determining the value of a feed. Cattle and other ruminants can digest large quantities of fiber; therefore, roughages, particularly fodders, grass hays, and various poor quality roughages, may have considerable value as cattle feed but none or very little as feed for swine. Cattle, for instance, can make efficient use of a certain amount of corncobs or cornstalks, whereas such feeds would be of little value in swine or poultry feeding.

Cottonseed meal can be given in relatively large amounts to cattle or sheep, often being the only protein concentrate fed. However, when fed in large quantities to swine or poultry, it has a toxic effect, and does not provide the amino acid or protein balance necessary for these animals.

The value of different feeds for the various classes of livestock will be discussed in the chapters which deal with specific animals.

DETERMINING FEED VALUES IN TERMS OF DIGESTIBLE NUTRIENTS

One of the most widely accepted methods of determining feed values is based on the total digestible nutrient content of the feed. Modern feeding standards list the total digestible nutrients and also the digestible proteins of the more widely used livestock feeds. A study of these tables (see pages 19–21) will tell us the average amount of digestible nutrients in a given amount of any

one feed. For example, in Table 1, No. 2 corn is shown as having a total digestibility of 80.1 per cent. This means that one bushel of shelled corn, which weighs 56 pounds, will provide 44.856 pounds of digestible nutrients. If corn costs $1.50 per bushel, then $1.50 divided by 44.856 will give us the cost of one pound of digestible nutrients supplied by corn.

To determine the cheapest source of digestible nutrients for any class of animals, the price per bushel, ton, or hundred pounds, whichever is the more common unit of measure, should be divided by the pounds of total digestible nutrients. This will give a comparative cost of various feeds based on feeding value. Although the cost per pound of total digestible nutrients is a very good guide to the value of a feed, it is not the whole answer.

Carbohydrates and Fats as Measures of Feed Value. Feeds are generally fed to do a specific job in the animal body. Corn is a fattening feed because of its high carbohydrate content, whereas soybean oil meal is fed for its high protein content.

If we wish to fatten a bunch of hogs or steers, it will be necessary to use one or more of the grains, such as corn, barley, wheat, or oats, along with enough protein to balance the ration. We will probably be interested in which feed will produce a hundred pounds of gain the cheapest. In our comparison of fattening feeds, we are interested in the nitrogen-free extract or carbohydrates as well as in the total digestible nutrients.

Proteins as Measures of Feed Value. Many feeds are purchased primarily for their protein content. They are used to increase the protein percentage in the ration, and the cost should be determined on a digestible protein basis.

In selecting protein feeds we should consider whether the product will give the amino acid balance needed for the class of livestock to be fed. Such proteins as cottonseed meal, soybean meal, or linseed meal will produce nearly equal results when fed to ruminants. The cost per pound of digestible protein may be used to determine which one to feed. However, in swine and poultry ration, none of these feeds, or any combination of them, will give the protein balance necessary for best results.

Generally, grains and roughages are not fed primarily for their protein content. Yet if they are high in this important nutrient, the cost of feeding is generally lower because less protein concentrates are necessary. For example, cattle fed legume hay will

produce beef or milk with much less protein meals than will those receiving a low-protein roughage. The protein content of roughages and grains becomes important in determining their feeding value.

Mineral Content as a Measure of Feed Value. Livestock feeds are seldom fed primarily for their mineral content. Minerals are provided by feeding salt, limestone, bone meal, and trace mineral mixtures. However, the calcium and phosphorus content of good legume forage and the mineral content of animal protein supplements are important considerations when determining their food value.

There are many different grades of limestone. Calcium is the important mineral supplied by limestone; therefore, calcium content is the chief measure of limestone value.

Bone meal, when added to the ration in the proper proportion, will generally give the needed amount of calcium and phosphorus. The chief measure of the value of bone meal is its phosphorus and calcium percentage.

Vitamins as Measures of Feed Value. Most farm feeds provide vitamins to some extent, but legume forage is especially valuable for its vitamin content. The high vitamin A content of yellow corn explains the chief difference between yellow and white corn as a livestock feed.

Fish liver oils and other vitamin preparations must be measured in terms of their vitamin content, because otherwise they have very little value.

QUALITY OF FEEDS

The amount of nutrients varies considerably in the same kind of feed, depending upon its quality.

Many factors, such as variety, type of soil, weather conditions, and age, affect the value of a feed and explain the wide range in digestible nutrients which may occur in the same kind of feed.

Corn may vary from 6 per cent to over 9 per cent protein, and alfalfa will range from 8 to 19 per cent protein. It is important that we consider carefully the quality of the product in judging the value of a feed.

Factors Affecting Quality of Feeds. Varieties of the same crop will differ in food value. The amount of protein in wheat varieties grown under the same conditions will vary from 10 to 16 per cent.

Oats that produce a plump berry with thin hulls are much higher in digestible nutrients than are those with a large proportion of hulls. State agricultural experiment stations can be relied upon to furnish information regarding varieties of crops for their particular state, together with comparative feeding values.

Soils. Recent experiments and analysis have shown that feeds produced on soils well supplied with plant foods have a higher feeding value than do those produced on poor land.

The mineral content of alfalfa and the protein in corn may vary, depending upon the soil. Land well supplied with nitrogen, from which plants make protein, will produce higher protein corn than will soils deficient in this plant food. Alfalfa grown on soils that are well supplied with lime and phosphorus will be higher in these elements than will alfalfa grown on deficient soils.

The appearance of a forage or grain may not be the best guide as to its food value. A knowledge of the area, or even the farm, where it was grown is important.

Weather. Unfavorable weather conditions influence feed values. Corn that is high in moisture as a result of cold, wet seasons will have much fewer digestible nutrients per pound than will dry corn. Small grains may have a high percentage of hull to berry; therefore the proportion of fiber is increased as a result of hot, dry weather conditions, particularly when the kernels are forming.

Analysis will show that the same kind of crop will vary in feeding value from year to year. The temperature, length of growing season, amount and distribution of rainfall all affect the nutrient value of crops.

Balancing a Ration Improves Its Digestibility. Milk, eggs, and meat are manufactured by animals according to a set formula. The percentage of each nutrient in these products remains about the same regardless of the kind of ration fed. If animals are given a low protein feed, they must eat greater quantities of the feed, and the excess carbohydrates will be eliminated as waste. For example, experiments have shown that hogs fed a ration made up entirely of corn will consume about thirteen bushels for every hundred pounds of gain. However, if the corn fed to swine is balanced with a good protein supplement, there will be a saving of approximately six bushels of corn per hundred pounds of gain.

Nutrients will be wasted if amounts are fed beyond the needs of the animal. Corn is an excellent fattening feed when balanced

with protein and mineral supplements. Corn, when fed alone, is usually inefficient and costly because the animal must consume large quantities in order to get sufficient amounts of the required protein. Balancing a ration will increase the value of all feeds used in the ration.

COMMERCIAL MIXED FEEDS

There are many companies engaged in the business of producing livestock feeds. Commercially mixed feeds for all classes of livestock are available in almost every community. When questions arise as to the value of one company's product as compared to that of another, we must consider the reliability of the manufacturer and the success that feeders have had with his products. A study of the analysis given on the container may be helpful. Most states permit feed companies to sell under what is known as the *closed formula* or *open formula.*

Feed Analysis Tags. *Closed formula.* Under the closed formula, feed companies are generally required to give the minimum crude protein, minimum crude fat, minimum nitrogen-free extract, and maximum amount of fiber contained in the feed. They must also list the ingredients that were used in making the product, but, except for mineral or ash, they are not required to tell how much of each ingredient has been used. Some states require that the percentage of mineral be listed. For example, a feed may be listed as containing soybean oil meal, tankage, meat scraps, and bone meal. Although this is a true statement of the ingredients used, it fails to give the amount of each product in the feed. Many feed companies prefer the closed formula because it prevents duplication of their products by other companies or livestock feeders.

The following is a typical closed-formula label that might appear on the feed bag:

WEIGHT 100 LBS. NET
FAST GROW PIG MEAL

Guaranteed Analysis

Crude protein not less than	26.00%
Crude fat not less than	4.50%
Nitrogen-free extract not less than	43.00%
Crude fiber not more than	8.50%

Ingredients: Alfalfa meal, wheat bran, tankage, soybean oil meal, fish meal, rolled oats, yellow corn, molasses, antibiotic, and vitamin supplement, calcium 6.0%, phosphorus 1.3%, salt 5.0%, iodine .0002%.

Open formula. Feed companies selling open-formula feeds must list the minimum percentage of protein, fat, nitrogen-free extract, maximum amount of fiber, and the weight of each ingredient contained in the feed. Following is an example of an open-formula feed label:

FAST GROW CHICK FEED

Guaranteed Analysis

Protein not less than	21.00%
Fat not less than	3.4%
Fiber not more than	7.4%
Nitrogen-free extract not more than	45.00%

Formula
(Pounds per ton)

470 yellow corn	150 dehydrated alfalfa meal
350 ground oats	320 soybean oil meal
150 wheat bran	100 meat and bone scraps
350 wheat shorts	15 salt
20 dried brewers' yeasts	5 trace mineral concentrate
40 ground limestone	5 vitamin antibiotic supplement
25 steamed bone meal	

SUMMARY

Many factors must be considered in evaluating feed. Among the more important considerations are the kind of animal to be fed and the purpose for which the particular feed is being used.

Feeds that are intended as fattening feeds must be judged primarily for their carbohydrate content and total digestibility. However, their protein, mineral, and vitamin contents are also important because the percentage of these nutrients in the feed determines the amount of other concentrates needed to balance the ration. The quality and percentage of digestible protein in a feed fed largely for its protein content is the chief measure of its value.

Mineral and vitamin concentrates are measured in terms of the essential minerals and vitamins present.

Quality of feeds are affected by weather, soils, harvesting, and varieties of crops.

The value of any feed in a ration is determined largely by how well the ration is balanced. Feeding more of any nutrient than the animal requires is wasteful. Commercial feeds are sold under open-formula or closed-formula analysis. More information is given on the label when the open-formula is used. The value of commercial feeds is determined largely by the reliability of the company and the success feeders have had with its product.

QUESTIONS

1. How does the class of livestock to be fed affect the value of the feed?
2. Show by example how you would determine the value of a feed, using total digestible nutrients as a measure.
3. Show how you would determine the value of a protein feed, using digestible protein as a measure.
4. Generally, roughages are not fed primarily for their protein content. Why then is the protein content of a roughage important in determining its value?
5. If concentrated amounts of vitamins A, D, E, B_{12} and other B vitamins are needed, what sources will furnish them?
6. How do soils and weather affect feed values?
7. Explain why poorly balanced rations waste feed.
8. Explain the chief difference in the two types of labels used for commercial feed mixtures.

REFERENCES

Anderson, Arthur L., *Introductory Animal Husbandry*, The Macmillan Company, New York, 1948.

Colorado State College, *Livestock Feeds and Feeding*, Fort Collins, Colorado, Bulletin 384–8, 1952.

Morrison, Frank B., *Feeds and Feeding*, 21st edition, The Morrison Publishing Company, Ithaca, New York, 1948.

U. S. Department of Agriculture, *Better Feeding of Livestock*, Farmers' Bulletin No. 2052, 1952.

Profitable Pork Production

< 5 >

The Pork Production Industry

It is estimated that more than 50 per cent of the corn grown in the Corn Belt is fed to hogs. Barley, oats, wheat, and grain sorghums are fed in large quantities to hogs in the states outside the Corn Belt, and garbage is also fed to hogs on those farms that are adjacent to our metropolitan centers.

Hogs are produced on more than 60 per cent of the farms and ranches in this country. They may be found on nearly 85 per cent of the farms in Iowa, and on 70 per cent or more of the farms in Illinois, Indiana, Missouri, Tennessee, Alabama, Mississippi, Louisiana, Georgia, and South Carolina. Less than 20 per cent of the farms and ranches in California, Nevada, Connecticut, New Hampshire, Massachusetts, and Rhode Island produce hogs. About one-third of the farm income of some of the Corn Belt states is derived from the sale of hogs, and pork production is a major enterprise on most Corn Belt farms. More than 75 per cent of the hogs marketed in this country are produced in twelve mid-western states.

Iowa leads all states in hog production and produces annually from 12 to 17 million head. It was estimated that the 1951 income to Iowa farmers from the sale of hogs was $937 million. This made up about 40 per cent of the state's total farm income for that year. On January 1, 1952 there were nearly 13 million hogs on the farms in Iowa.

PORK AND LARD CONSUMPTION

In this country we consume more pork than any other kind of meat. During the 1929–1949 period the average American consumed 144.6 pounds of meat per year. The average consumption of pork (excluding lard) was 69.9 pounds. The 1951 meat consumption was estimated to be 141 pounds per person, of which 72

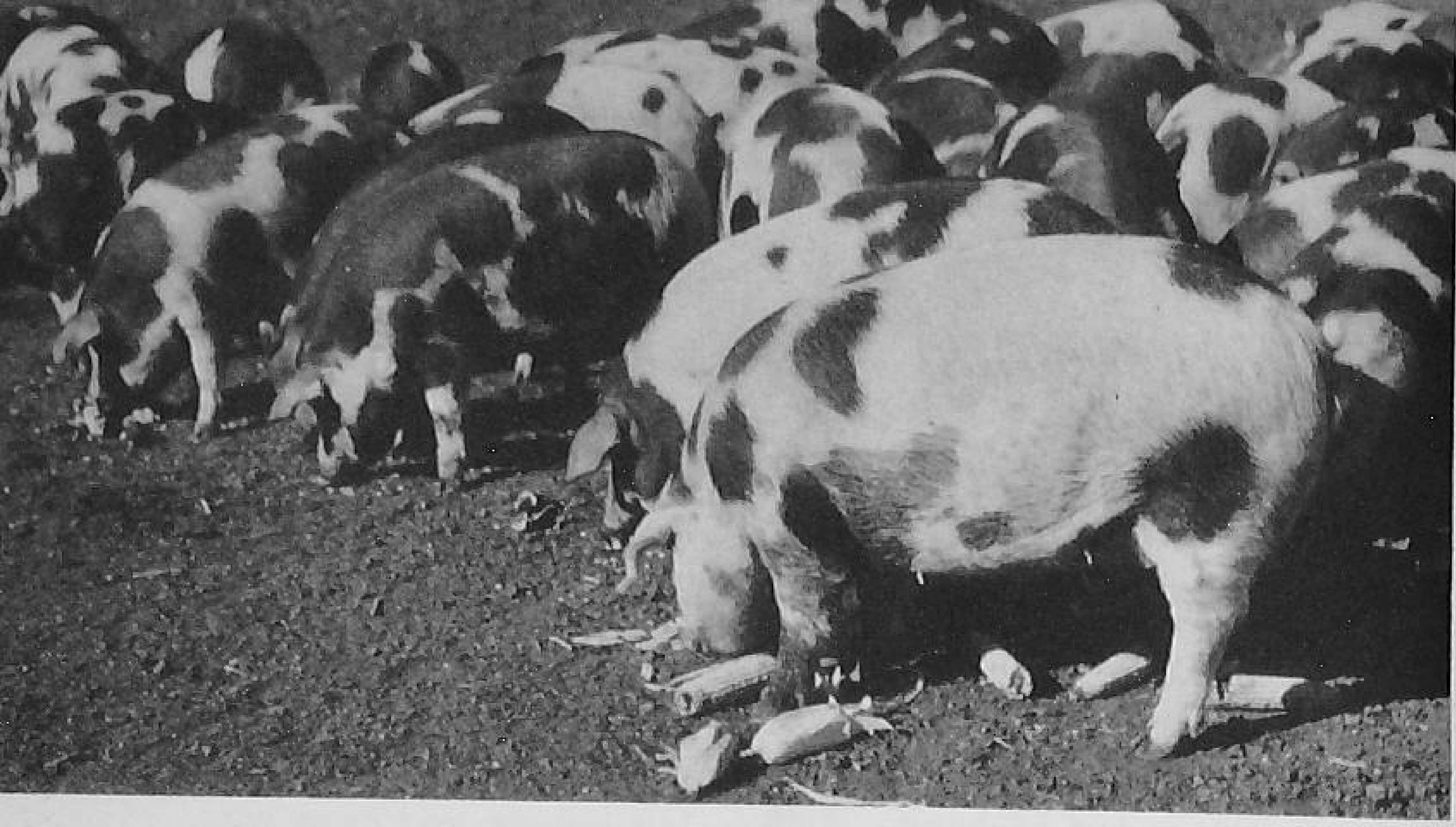


FIGURE 9. *A typical scene on a Corn Belt farm. More than 75 per cent of the nation's hogs are produced in twelve states.* (Courtesy Wallaces' Farmer and Iowa Homestead.)

pounds was pork. The 1952 meat consumption was 142 pounds, which was about equal to the 1948–1950 level. The population of our nation is increasing each year, and it is probable that the average meat and pork consumption will decrease considerably in the next few years unless we increase our total production. Slightly over 99 million hogs were produced in 1950, when our population numbered 152 million persons. To provide pork and lard for our anticipated 1975 population of 192 million persons, it will be necessary to increase our production of hogs to about 121 million head. Hog production is big business, and will continue to be.

ADVANTAGES OF HOG PRODUCTION

Hog production is well adapted to both specialized and diversified types of farming, and the returns come much more quickly than do those from many other enterprises. The investment in swine breeding stock and in equipment is relatively small, and it is possible to get in and out of the business in a comparatively short time. The feeding of corn and other grains to hogs is a profitable method of marketing these grains. It also is an efficient way of producing meat. A pound of pork can be produced on as little as three to four pounds of feed. The young chicken is the only other animal which can produce a pound of meat on this amount of feed. No other farm animal excels the hog in ability to produce high-quality fat.

The raising of hogs on rotated pasture (shown in Figure 10)

FIGURE 10. *Chester White pigs on rotated pasture in Ohio. (Courtesy Chester White Swine Record Association.)*

and the use of portable houses, waterers, and feeders has made it possible for farmers and ranchers to realize a greater gross income per $100 invested than that realized from most other types of livestock.

THE LARD PROBLEM

The substitution of vegetable oils and fats in cooking and the decrease in use of animal fats in soap-making have lowered the demand for lard. The price paid by the packer for live hogs is determined by the consumer demand for the pork cuts and lard, and by the supply available. Today consumers are eating more pork, but they are eating the lean cuts, the hams, loins, picnics, and Boston butts. They buy less fat cuts and lard. They insist that the fat on the hams, picnics, and chops be trimmed. As a result, we are producing more lard than we can sell profitably even though we export lard to other countries. In 1950 we exported 466,084,000 pounds of lard, almost three times the amount of lard exported during the 1935 to 1939 period. We exported nearly 140 million pounds of lard to Cuba in both 1951 and 1952. Almost 25 per cent of our total lard production was exported in 1951.

Lard represents about 15 per cent of the weight of the live hog, but only about 10 cents of each dollar spent for pork products is spent for lard. The types of hogs now being produced and the methods used in getting rapid gains on our hogs have resulted in a serious lard problem. If the same relationship existed today as

existed in the 1935–1939 period between the price of the fat cuts and lard and the price of the lean cuts, the total value of 100 pounds of live hogs would be several dollars higher than it is.

The amount of lard consumed per person per year in this country has not changed materially during the past twenty years. A major problem of hog breeders and feeders is to find a way to produce a pork carcass with a higher percentage of lean meat and a lower yield of fat cuts and lard. Considerable progress can be expected during the next five or ten years. Breeders are improving the conformation of breeding animals, and nutrition specialists are developing better methods for producing pork of high quality.

EFFICIENCY IN PORK PRODUCTION

The profit in producing hogs is determined largely by the efficiency of the grower in production and marketing practices. It has been estimated that the average farmer loses at least 25 per cent of the pigs farrowed. Records indicate that sows farrow an average of eight to ten pigs per litter, but only six or seven of these pigs are saved. The cost of maintaining a brood sow from breeding time until the pigs are weaned is about the same regardless of the number of pigs farrowed and weaned. We must give more emphasis to the saving of larger litters of pigs.

The loss of pigs due to disease is great. Hogs are subject to a large number of diseases, such as cholera, erysipelas, brucellosis, rhinitis, enteritis, baby pig disease. It is difficult to estimate the

FIGURE 11. *Hog profits begin with good litters. This Poland China litter in Nebraska is off to a good start. (Courtesy Clark J. Huber.)*

losses due to these diseases. Some animals die; others are weakened. Considerably more feed is required to feed out diseased hogs, additional time is necessary to get them on the market, and they cannot be sold when the market is high. Often, due to the disease, the carcass of the animal must be condemned entirely or in part, and sometimes the packer must offer a lower price for the diseased animals. The efficient producer uses practices which prevent disease outbreaks.

Care must be taken also to prevent losses due to swine parasites. Worms and mange probably cause some loss on most farms.

The efficient producer of hogs must be very careful in the selection of breeding stock and in the breeding of these animals, and many swine breeders are now maintaining production records. Good feeding and disease control cannot entirely offset losses due to poor quality breeding stock and the use of poor breeding methods.

Nearly 80 per cent of the cost of producing a pound of pork goes for feed. The efficient producer selects feeds carefully and feeds them in proper balance. He makes adequate use of home-grown grains and forages, and uses protein supplements, minerals, antibiotics, and vitamins to supplement the home-grown feeds. He tries to produce a pound of pork for three to four pounds of feed.

It is possible to produce profitably but at the same time to market inefficiently. Markets are better in some seasons than they are in others. Packers pay higher prices for hogs of certain weights than they do for others. Some packers pay higher prices for hogs of high quality than do other buyers. Through careful planning it is possible to have ready for market the kind and weight of hogs that will top the market. Efficiency in marketing is most important.

SUMMARY

Hog production is big business in this nation, especially in the Corn Belt states. In this country we consume more pork than any other type of meat. With increases in our national population each year, it is necessary for us to step up our production of meat animals.

Hog raising is a profitable enterprise which requires a comparatively small investment, and the returns come rather quickly.

The market for lard has not kept pace with the market for pork. As a result of lard surpluses, the price of live hogs is not in line

with the price of other meat products. Pork producers must find a way to produce hogs with more lean meat and less fat.

The successful pork producer in the future must (1) use sound methods in selection and breeding, (2) be efficient in feeding and management, (3) control diseases and parasites, and (4) use good judgment in his marketing operations.

QUESTIONS

1. What percentage of the income on your farm is derived from the sale of hogs?
2. What percentage of the grains produced on your farm is fed to hogs?
3. What percentage of the agricultural income in your state is obtained from the sale of hogs?
4. How many pounds of lard can you buy at your local meat market for the price of a pound of pork chops?
5. What do you think can be done to decrease the lard produced on our farms without reducing the production of the high-priced pork cuts?
6. Why do people consume more pork than any other meat?
7. How do people account for the fact that hogs are grown on more than 60 per cent of the farms in the nation?

REFERENCES

Anderson, Arthur L., *Swine Management*, Chapter I, J. B. Lippincott Company, Philadelphia, 1950.

McMillen, W. N., *Hog Profits for Farmers*, Chapter I, Windsor Press, New York, 1952.

< 6 >

Selection of Breeding and Feeding Stock

The pork producer must make a number of decisions before he obtains his breeding stock. He must first decide whether to grow meat- or bacon-type hogs; then he must determine which breeding program to follow. He usually has at least three plans to consider. He can start with grade or crossbred sows and upgrade them, selling the offspring as market hogs, or he can start with purebreds and maintain a purebred herd, selling the offspring to other breeders for breeding purposes or disposing of them as market hogs. His third possibility is to start with grade, crossbred, or purebred sows and follow a plan of crossbreeding in producing hogs for the packer market.

The third decision to be made is usually a difficult one. What breed or breeds should he grow? There are numerous breeds of swine available. Which of them is best suited to the breeding program that he plans to follow? The breeding program and the breed or breeds of hogs are both determined in part by the methods he plans to use in marketing his hogs.

A number of factors must be considered in selecting a breed, and the selection of desirable breeding animals within the chosen breed involves additional problems. What body conformation is desired? Shall the producer use proven sows and sires or select young, untried breeding stock? In selecting animals how much importance should he place on rate of gain, economy of gain, prolificacy, and freedom from disease?

Good breeding stock is essential for the most profitable hog production enterprise. It is sometimes possible for a hog producer to overcome in part the lack of good breeding stock by efficient feeding, good management, and disease control. For maximum returns, however, it is necessary that he start out with the right kind of breeding animals.

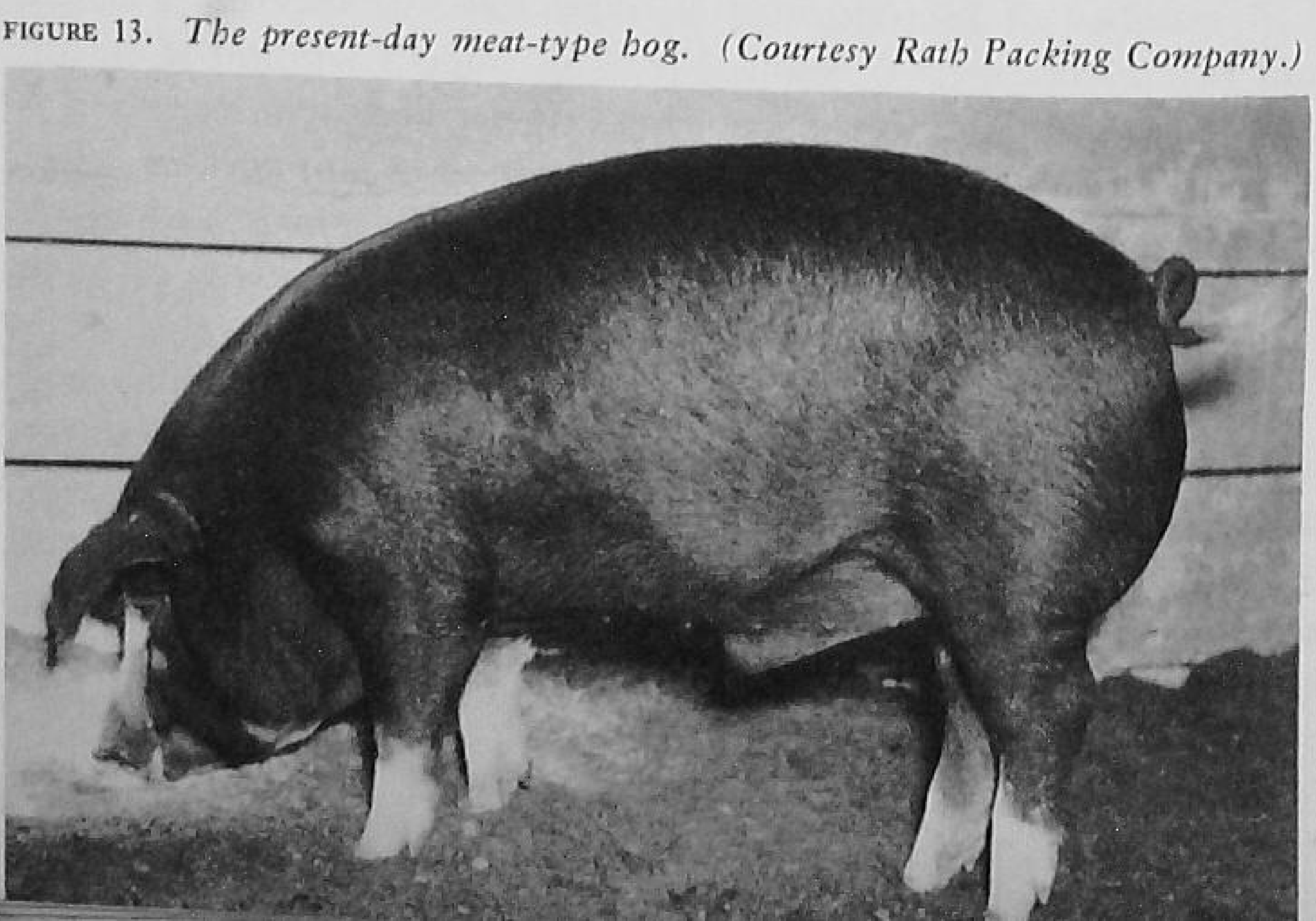
FIGURE 12. *A champion lard-type boar during the 1910–1915 period.* (Courtesy Wallaces' Farmer and Iowa Homestead.)

The factors to be considered in selecting breeding and feeding stock are enumerated in this chapter, and suggestions are offered to aid the reader in making wise decisions when choosing animals for the home farm enterprise.

TYPES OF HOGS

The type of hog produced in this country has varied from time to time during the past century. Originally there were two types. The lard type, as the name implies, was a thick-bodied hog which, in market condition, carried a large amount of fat. Before the development of the vegetable fat industries, lard was a valuable product on the market, and hogs which yielded carcasses high in

FIGURE 13. *The present-day meat-type hog.* (Courtesy Rath Packing Company.)



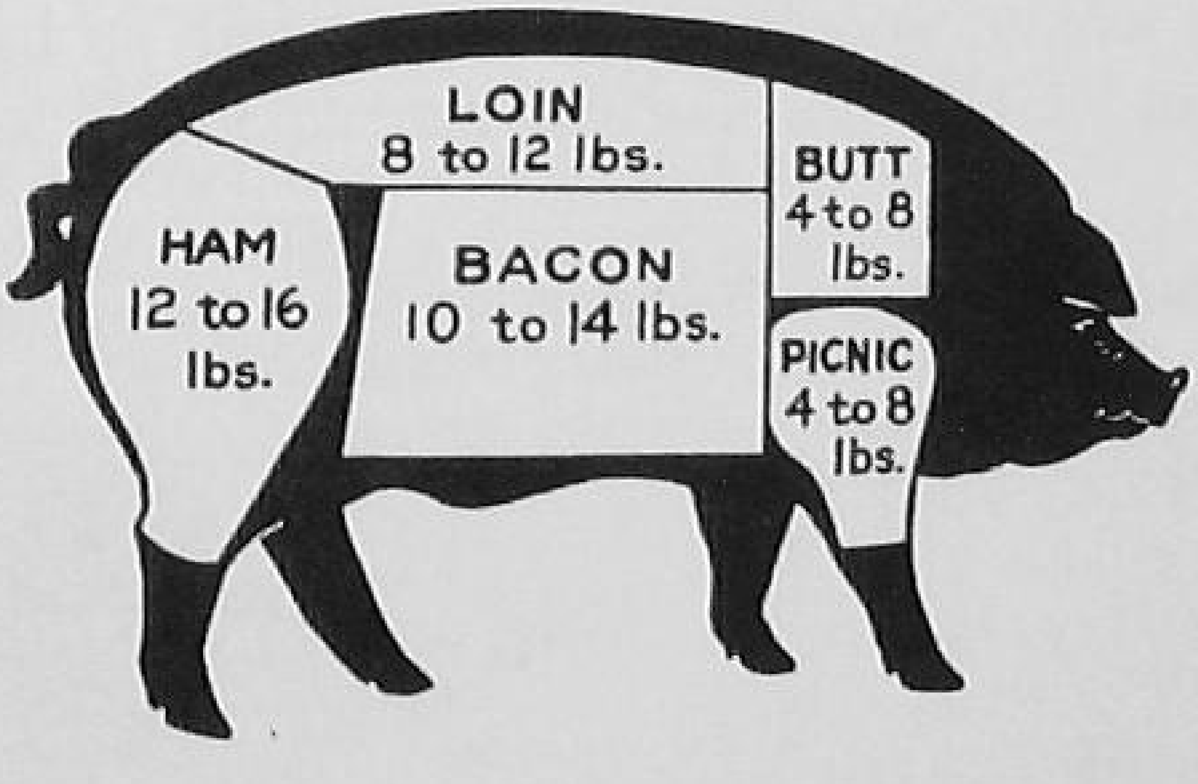
lard were grown. Corn has always been a basic food for hogs, and it produced carcasses with high lard content. Up to a few years ago most of the hogs produced in this country were of the lard type.

The competition of vegetable fats on the market has de-emphasized the value of lard, and during recent years hog breeders have tried to develop a hog which would yield a carcass high in lean meat, but comparatively low in lard. The lard-type hog of a few years ago has now become the meat-type hog. Most of the hogs produced in this country today are of this type.

The Meat-type Hog. The Berkshire, Chester White, Duroc, Hampshire, Hereford, OIC, Poland China, and Spotted Poland China breeds are classified as the meat-type breeds. Although there are some differences between breeds, the producers of the various breeds all strive to produce a 210- to 230-pound market hog which has a carcass about 29½ to 31 inches long, and with only about 1.5 inches of back fat. The ideal carcass from a 220-pound hog should yield about 50 per cent of the liveweight of the hog in the five primal cuts: ham, bacon, loin, picnic, and Boston butt.

200—240 LB. HOGS

AVERAGE % OF CARCASS	
Ham	18 %
Bacon	15.5%
Loin	13.5%
Picnic	9 %
Butt	7 %



APPROXIMATE % OF VALUE	
Ham	28 %
Bacon	16 %
Loin	20.5%
Picnic	9.5%
Butt	9.5%

IN THE DIAGRAM ABOVE THE WEIGHT RANGES SHOWN INDICATE THE WEIGHT OF CUT CONSUMERS NORMALLY PREFER

FIGURE 14. *Average weight of primal cuts. (Courtesy John Morrell & Co.)*

The *average* carcass should yield about 18 per cent ham, 17 per cent bacon, 14 per cent loin, 8 per cent picnic, and 6 per cent Boston butt. The *ideal* carcass should yield about 19 per cent ham, 15.2 per cent bacon, 15.8 per cent loin, 9.7 per cent picnic,

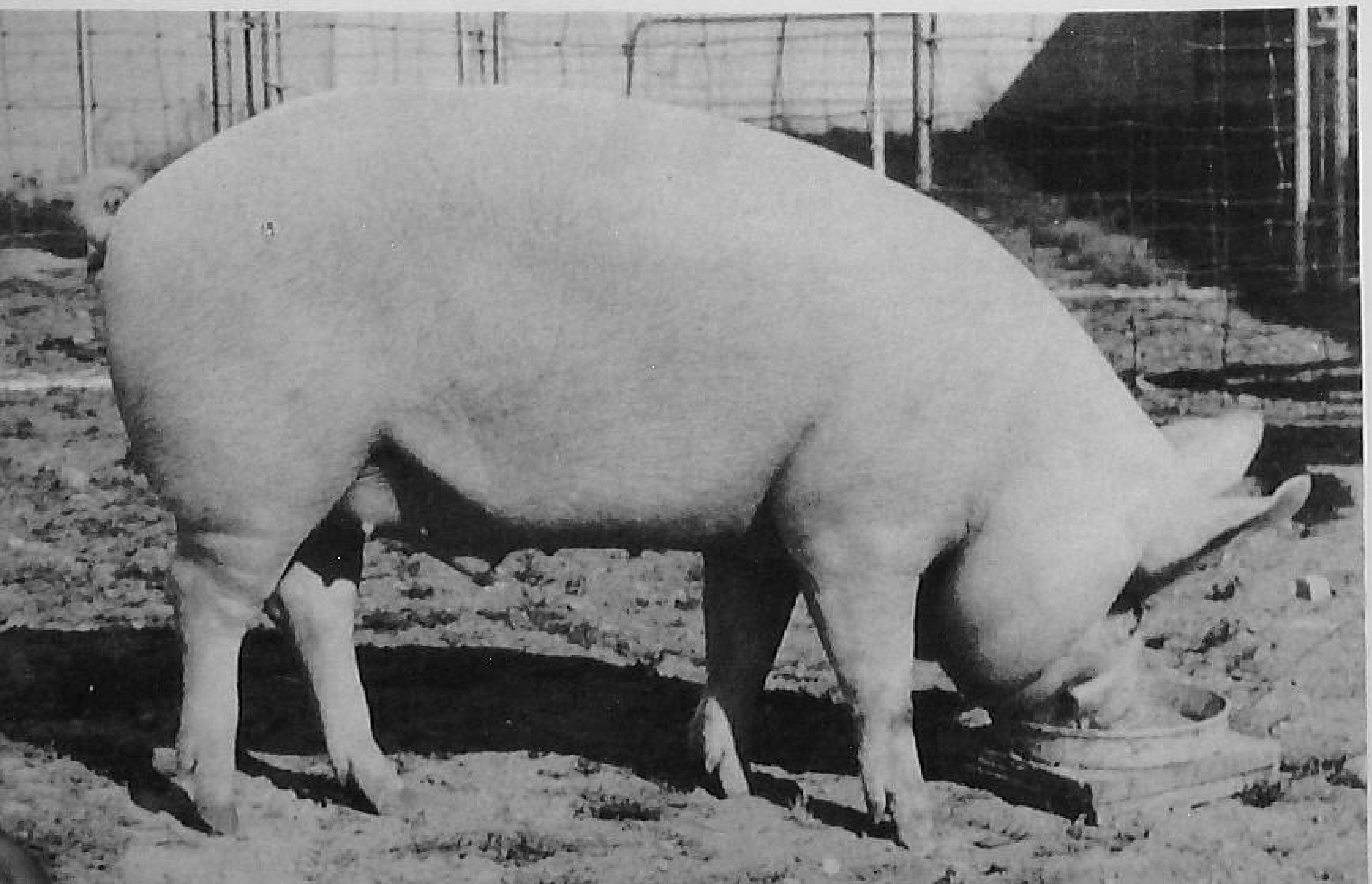
and 6 per cent Boston butt. The lard content of the carcasses will vary. The average 220-pound hog will yield a carcass containing 32 to 34 pounds of lard. Since lard is the cheapest part of the carcass, it is desirable to breed a type of hog low in lard and high in muscling or in the amount of the more valuable cuts: the hams, bacon, and loins.

The Bacon-type Hog. The packers have been promoting the bacon breeds of hogs for many years, but hog producers have been slow in accepting them as the desired type. The Danish Landrace, Tamworth, and Yorkshire are the three breeds of bacon-type hogs now being produced in this country. Some new breeds which have been developed by crossing lines of these breeds with some of the meat-type breeds are now in formation. These breeds are not being produced in large numbers at this time.

The bacon-type hog was produced originally to meet the demand of the consumers in England and Ireland for the "Wiltshire sides" of bacon. Most of the hogs produced in Canada are of the bacon type. The bacon breeds have been imported, and although they are not being raised in large numbers in this country, they have been used extensively in crossbreeding.

The bacon-type hog is considerably longer than the meat-type hog. It has a longer, smoother, and meatier side of bacon. It has a thinner layer of backfat, and the carcass yields less lard. Its

FIGURE 15. *A bacon-type hog. Champion Yorkshire barrow at the National Barrow Show. (Courtesy Harlan Moore.)*



carcass is higher in percentage of the primal cuts, especially in bacon and loins.

BREEDING SYSTEMS

We have already pointed out that farmers select breeding stock to meet the demands of the breeding programs which they are following. Most growers produce hogs for slaughter. It is estimated that less than 4 per cent of all growers are raising purebred hogs to be sold for breeding purposes. More than 96 per cent of our producers have no interest in selling breeding stock. They produce only market hogs.

The breeding programs followed by breeders of purebred hogs are often quite different from those followed by producers of market hogs. These breeders mate purebred boars and sows of the same breed. Some breeders do inbreeding or line breeding. Most breeders of commercial hogs follow upgrading, crossbreeding, or criss-crossing methods, which may involve two or more breeds. A description of each of the various swine-breeding systems may be found in the following paragraphs.

Upgrading. The system of mating purebred boars with grade sows of the same breed is called *upgrading.* A purebred is an animal that is registered or eligible for registration by a breed association. A grade animal is one whose sire is a purebred but whose dam or mother is not eligible for registration. The use of a purebred Chester White boar on a grade sow herd of the same breed is an example of upgrading.

Use of this method has resulted in much improvement of our grade herds in type and productiveness. The development and maintenance of many herds of purebred swine has provided farmers with sources of boars for the production of market hogs. The pigs produced are uniform in color and breed characteristics. Through careful selection of the sire and gilts it has been possible to improve market-hog production.

Purebred Breeding. In the breeding of purebreds, purebred boars are mated to purebred sows of the same breed. The mating of purebred Hampshire boars with purebred Hampshire sows is an example of purebred breeding. Accurate information is not available, but it is probable that less than 4 per cent of all hogs on farms are purebreds. Breeders of purebreds must produce boars for use by their neighbors who raise market hogs; they must also

produce purebred animals for use by other breeders of purebreds. Breeders have attempted to improve their herds through careful selection. Type, quality, and performance have been improved. For many years much of the improvement had to do with type factors, but during recent years considerable attention is being given to production factors, such as number of pigs farrowed and weaned, weight of litter at weaning time, rate of gain, and economy of gain.

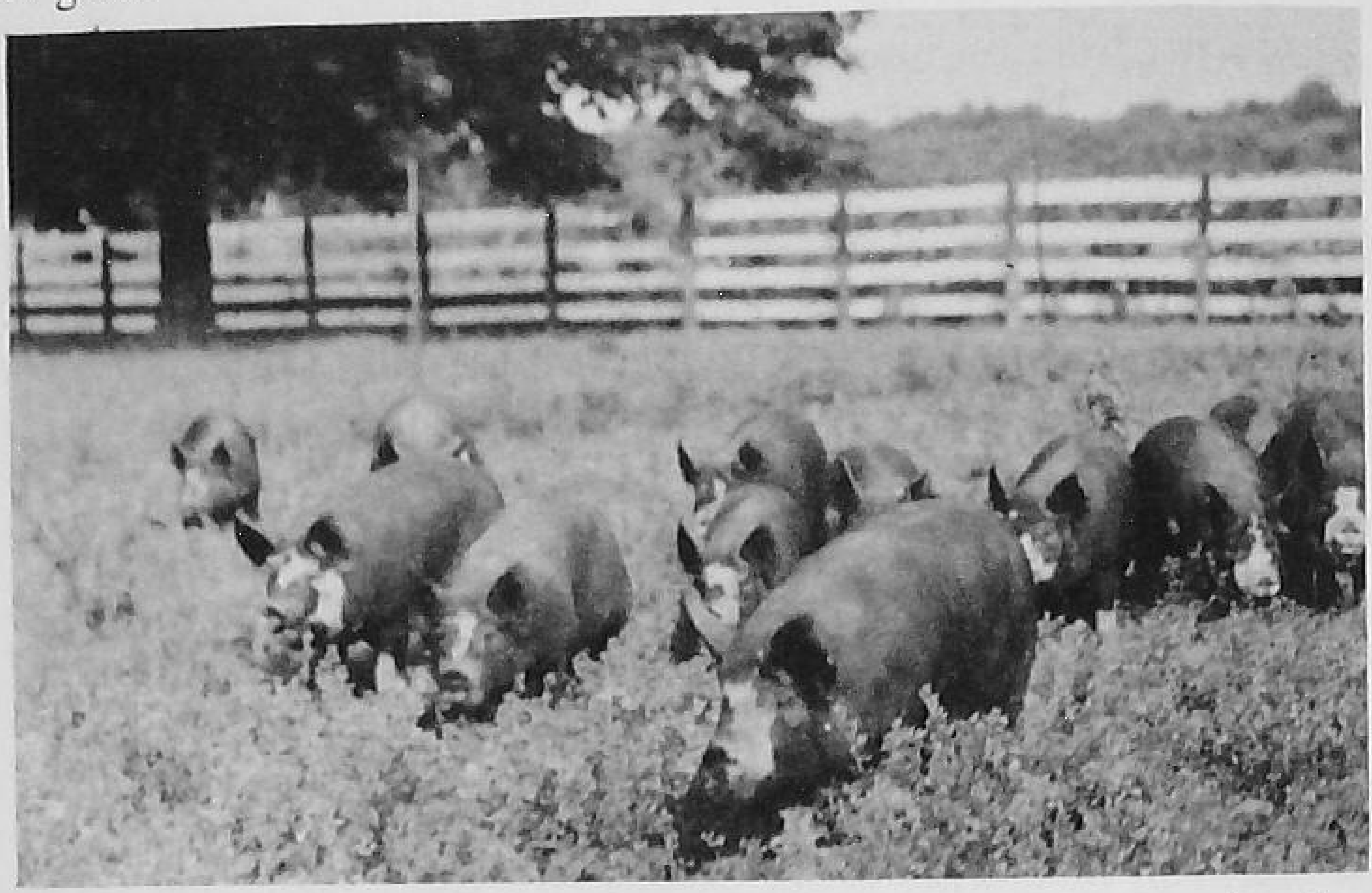


FIGURE 16. *Purebred Berkshire pigs on alfalfa pasture.* (*Courtesy American Berkshire Association.*)

Crossbreeding. The mating of purebred or inbred boars of one breed with purebred or grade sows of another breed is called *crossbreeding*. From studies made of the hogs received at the packing plants, it was found that from 60 to 80 per cent of the hogs possessed the characteristics of more than one breed. A large percentage of commercial hog producers are crossbreeding or are criss-crossing their hogs. An example of this system of breeding is the mating of a Duroc boar with Tamworth sows.

In tests conducted at Iowa State College over a ten-year period, it was found that fewer pigs were born dead among the crossbreds and that slightly more of the crossbred pigs lived to weaning age than did the purebred pigs. The crossbred pigs weighed an average of nearly 4 pounds heavier at weaning time than did the purebreds. The crossbreds gained more rapidly from weaning to

FIGURE 17. *Crossbred pigs on alfalfa and ladino pasture in Indiana. Hampshire sows were mated to a Montana No. 1 boar. (Courtesy The Farm Clinic.)*

market and reached market weight of 225 pounds about ten days earlier than did the purebreds. Twenty-five to 30 more pounds of feed were required to bring the purebreds up to 225 pounds than were required for the crossbreds.

The crossbred sows were good mothers when bred back to a boar of either of the parent breeds or to a boar of a third breed. The pigs produced compared favorably with the first-cross pigs in rate of gain and in economy of gain.

In Ohio tests pigs produced by crossing purebred Durocs and Poland Chinas weighed 22 pounds more at 180 days than did purebred Duroc pigs. The daily gain was .12 of a pound more, and the litter weight at 180 days was 180.1 pounds heavier. Litters resulting from a three-way cross of Duroc, Hampshires, and Poland Chinas weighed 105.5 pounds more at 180 days than did the purebred Duroc litters. The pigs averaged 8.7 pounds less than did the purebred Duroc pigs, but .9 more pigs per litter were saved.

The best gains in the Ohio tests were made by pigs produced by mating the Duroc-Poland-Hampshire crossbred gilts with purebred boars of the same breeds. The purebred Duroc litters averaged 6.7 pigs at 180 days, whereas the crossbred litters averaged 8.0 pigs. The crossbred pigs weighed 12.4 pounds heavier at 180 days, and the litters averaged 333.3 pounds heavier than did the purebred Duroc litters. A summary of the Ohio tests is shown in Table 6.

TABLE 6

CROSSBRED AND PUREBRED PIGS *
(Miami County, Ohio, Experimental Farm)

A–Two-breed crossbreds
B–Three-breed crossbreds
C–Crossbreds of subsequent generations

	A		*B*		*C*	
	Duroc	*P. C. and Duroc*	*Duroc*	*Hamp. and PC & D*	*Duroc*	*Crossbreds from Sows of Sub. Gen.*
Litters from gilts..	10	12	2	4	15	18
Litters from sows..	19	21	5	3	16	12
Average gestation (days)	114.5	114.3	113.5	113.3	115.0	113.5
Live pigs per litter at birth	9.3	9.1	9.9	9.9	10.3	9.7
Dead pigs per litter at birth	0.4	0.3	0.4	0.4	0.5	0.4
Total pigs per litter at birth	9.7	9.4	10.3	10.3	10.8	10.1
Pigs per litter at weaning	6.4	6.4	6.4	7.4	7.0	8.1
Average adjusted wt. at 56 days	31.2	36.2	32.3	31.6	36.8	36.9
Per cent live pigs lost before weaning..	31.7	29.8	34.8	24.6	31.9	16.4
Per cent live pigs lost after weaning ...	2.6	0.7	0.0	1.4	2.8	1.7
Pigs per litter at 180 days	6.1	6.4	6.4	7.3	6.7	8.0
Average daily gain, birth to 180 days (lbs.)	.99	1.11	1.10	1.05	1.06	1.13
Average weight per pig at 180 days (lbs.)	178.3	200.3	197.1	188.4	191.4	203.8
Average weight per litter at 180 days (lbs.)	1094.5	1274.6	1267.3	1372.8	1290.6	1623.9

* Bulletin 675, Ohio Agricultural Experiment Station, Wooster, 1948.

Criss-crossing. In this system purebred boars of one breed are mated with grade or purebred sows of another breed (as in cross-breeding); then the gilts produced from the first mating are mated with a boar of the same breed as the original sows. The gilts produced from this cross are mated the next year with a boar of the same breed as the boar used in making the first cross. Boars of

the parent breeds are then used in alternate years thereafter. A farmer who breeds a group of Spotted Poland China gilts to a Duroc boar and then alternates the use of boars of these two breeds in the following years is using the criss-cross method.

Success in crossbreeding and in criss-crossing depends primarily upon the effectiveness of the breeder in selecting breeds and families within the breeds that nick. A recent study in one of the Corn Belt states indicated that Duroc-Poland China, Duroc-Spotted Poland China, Duroc-Hampshire, Hampshire-Poland China, and Hampshire-Spotted Poland China crosses were most prevalent in that state.

Rotation Breeding. Swine specialists in several states are now recommending the use of boars of three or four breeds of hogs in rotation. This method is especially recommended when inbred boars are used in producing commercial hogs. The use of four carefully selected breeds maintains the hybrid vigor desired in hog production. The boars used in this system of breeding may be purebreds, inbreds, or crosslines. Crosslines are the progeny resulting from the crossing of two inbred lines of the same breed.

An example of this method follows: A farmer has a Duroc sow herd which he mates to a Poland China boar. The gilts from this cross are mated the next year to a Montana No. 1 or Hamprace boar. During the third year he uses a Spotted Poland China boar, and in the fourth year he uses a Duroc boar. The rotation system is then repeated. Some breeders prefer to use just three breeds in the four years. By using the latter system, 50 per cent of the boars will be of one breed, and 25 per cent of them will be of each of the other two breeds. A rotation involving Duroc, Poland China, Duroc, and Hamprace boars has produced excellent results.

Inbreeding. The mating of boars with sows of the same breed which are closely related is called *inbreeding.* The mating of brothers with sisters and of sires with daughters are examples of inbreeding. Purebred and commercial producers have frowned upon inbreeding because usually the offspring are inferior to the parent in growth ability and in prolificacy. After several years of inbreeding, however, it is possible to obtain lines which produce uniform offspring. The crossing of two or more of the inbred lines results in hybrid vigor which is greater than that obtained when two noninbred purebred lines are crossed.

State agricultural experiment stations, the Regional Swine Breeding Laboratory, and the U.S.D.A. Agricultural Research Center at Beltsville, Maryland, have been largely responsible for the inbreeding work which has been done with swine. Approximately one hundred inbred lines have been tested, and many of the lines have been dropped because of poor performance. The best lines of at least seven breeds have been retained and are being used in making line crosses.

Line Breeding. Line breeding involves the mating of purebred boars of one line or family with sows of the same line that are not so closely related as those used in inbreeding. The mating of second cousins is an example of line breeding. Many breeders of purebred hogs have used line breeding to intensify the desirable characteristics of certain blood lines in their herds. An examination of the pedigrees in most herds will produce many examples of line breeding. This method is rarely used in producing market hogs.

Crossline Breeding. When this system is used, inbred boars of one line are mated to inbred sows of another line of the same breed. This method has been used extensively at the U.S.D.A. Agricultural Research Center at Beltsville, Maryland, at the Regional Swine Breeding Laboratory, and at cooperating state agricultural experiment stations.

The crossing of two distinct lines of a breed produces a type of hybrid vigor similar to, but in smaller amounts than, that resulting from the crossing of two breeds. Crossline breeding cannot be done economically at the present time in commercial hog production, and breeders of purebred hogs do not usually use this system because the lines have not been inbred sufficiently to be distinct.

Hybrid vigor is increased about 12 to 15 per cent as a result of the crossing of two inbred lines. By crossing four lines, as is done in producing hybrid corn, the hybrid vigor is further increased. By crossing lines of different breeds, it is possible to obtain higher levels of performance than can be obtained by crossing two lines of one breed. Swine breeders are working on the development of inbred lines of various breeds and experimenting to determine the line crosses which will produce the largest amount of hybrid vigor.

BREEDS OF HOGS

We have a number of breeds of hogs in this country, and each

breed has a loyal group of supporters. There is considerable rivalry and competition between the producers of the various breeds. Each of the breeds has desirable characteristics, and all of them have some weaknesses. There are perhaps more differences among the individuals within a breed than there are between the breeds.

The following factors should be given careful consideration in the selection of a breed of hogs:

1. Availability of breeding stock
2. Prolificacy
3. Growth ability
4. Temperament
5. Carcass quality
6. Market demand
7. Disease resistance
8. Feeds available
9. Personal likes and dislikes of the grower.

Classification of Breeds. The most common breeds of hogs produced in this country are classified according to type of carcass, color of hair, and type of ears as follows:

MEAT-TYPE HOGS

Breed	*Predominant Color of Hair*	*Type of Ears*
Berkshire	Black	Erect
Chester White	White	Drooping
Duroc	Red	Drooping
Hampshire	Black-white belt	Erect
Hereford	Red-white head	Drooping
OIC (Ohio Improved Chester White)	White	Drooping
Poland China	Black	Drooping
Spotted Poland China	Black and white spotted	Drooping

BACON-TYPE HOGS

Breed	*Predominant Color of Hair*	*Type of Ears*
Danish Landrace	White	Drooping
Tamworth	Red	Erect
Yorkshire	White	Erect

Although the Danish Landrace breed is listed with the common breeds of hogs, this breed was not imported from Denmark until 1934, and no breed association exists in this country for the recording of pedigrees. The breed, however, has been used in swine-breeding work throughout the nation, and its influence is recognized by most swine breeders.

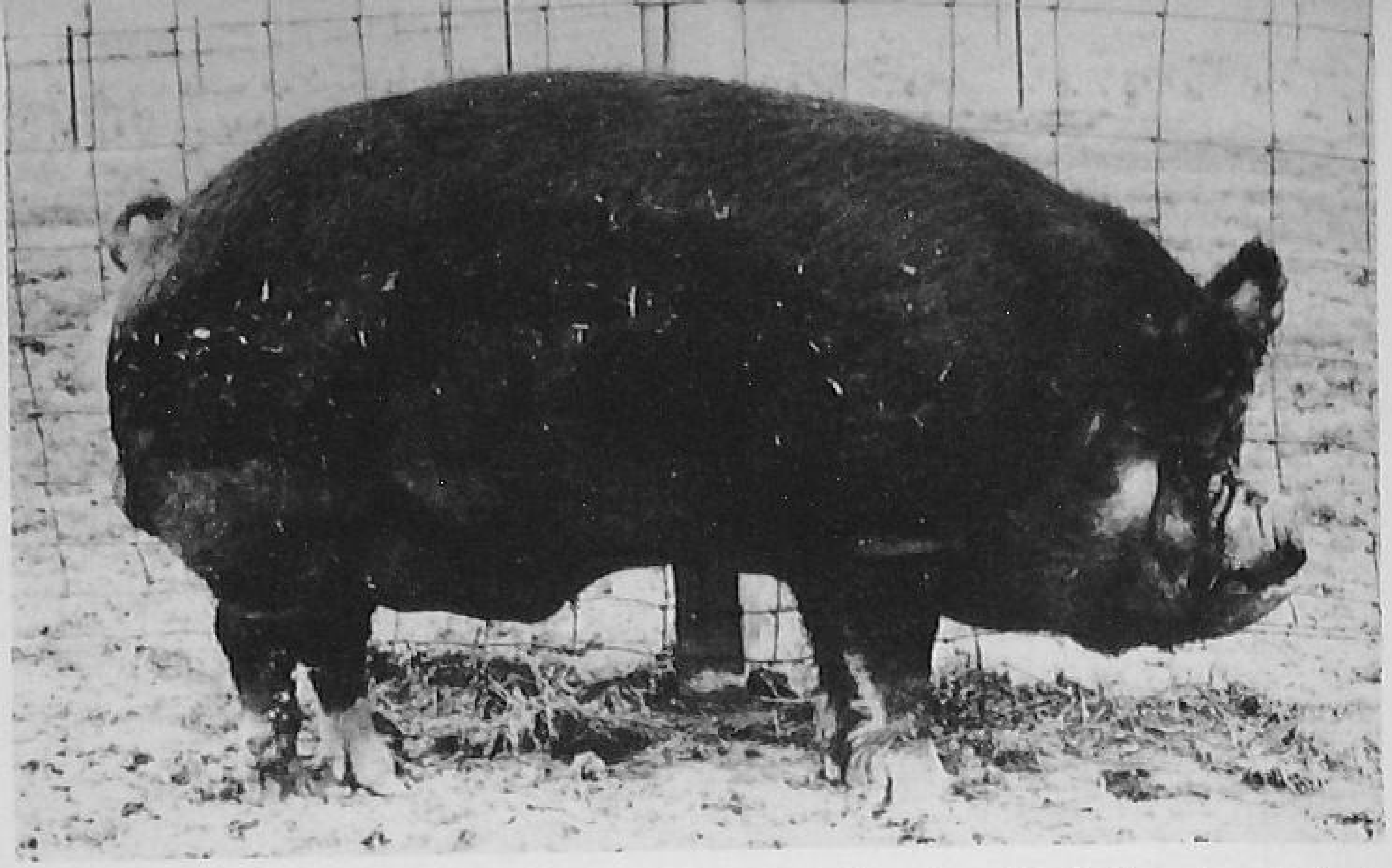


FIGURE 18. *A mature Berkshire boar. (Courtesy American Berkshire Association.)*

Several other breeds of hogs have been raised in small numbers for many years. The Kentucky Red Berkshire, the Essex, and the Mulefoot breeds are still being produced, and record associations are maintained for the recording of pedigrees.

Origin and Characteristics of the Breeds. *Berkshire.* This breed, which originated in England, is the oldest of the lard- or meat-type breeds. For many years it was considered the best of the meat breeds because of the excellent carcasses which it produced. The champion barrows and carlots of barrows at national shows often carried Berkshire breeding. During recent years the other breeds have been improved, and now there is less difference in the quality of the carcasses. The Berkshire still rates high, however, as a producer of a good carcass.

The Berkshire is an extremely long animal and in form and fleshing conforms to the ideal meat-type hog. The breed is black, with white markings usually on the feet, head, and tail; it has long been characterized by a short snout and a wide, dished face. The "pug nose" of the Berkshire of years ago has been well refined through breeding.

Berkshires are slightly smaller than some of the other meat-type breeds at maturity. Mature boars will weigh 900 pounds or more. In 1952 there were 18,051 Berkshire swine recorded in this country. This breed has had general use in crossbreeding programs with excellent results.

Chester White. The Chester White breed had its origin in Chester and Delaware counties in Pennsylvania. The parent stock used to produce the breed included English Yorkshire, Cheshire,

and Lincolnshire bloodlines. All were English breeds which had been imported during the early 1800's. The Chester White Swine Record Association was established in 1908.

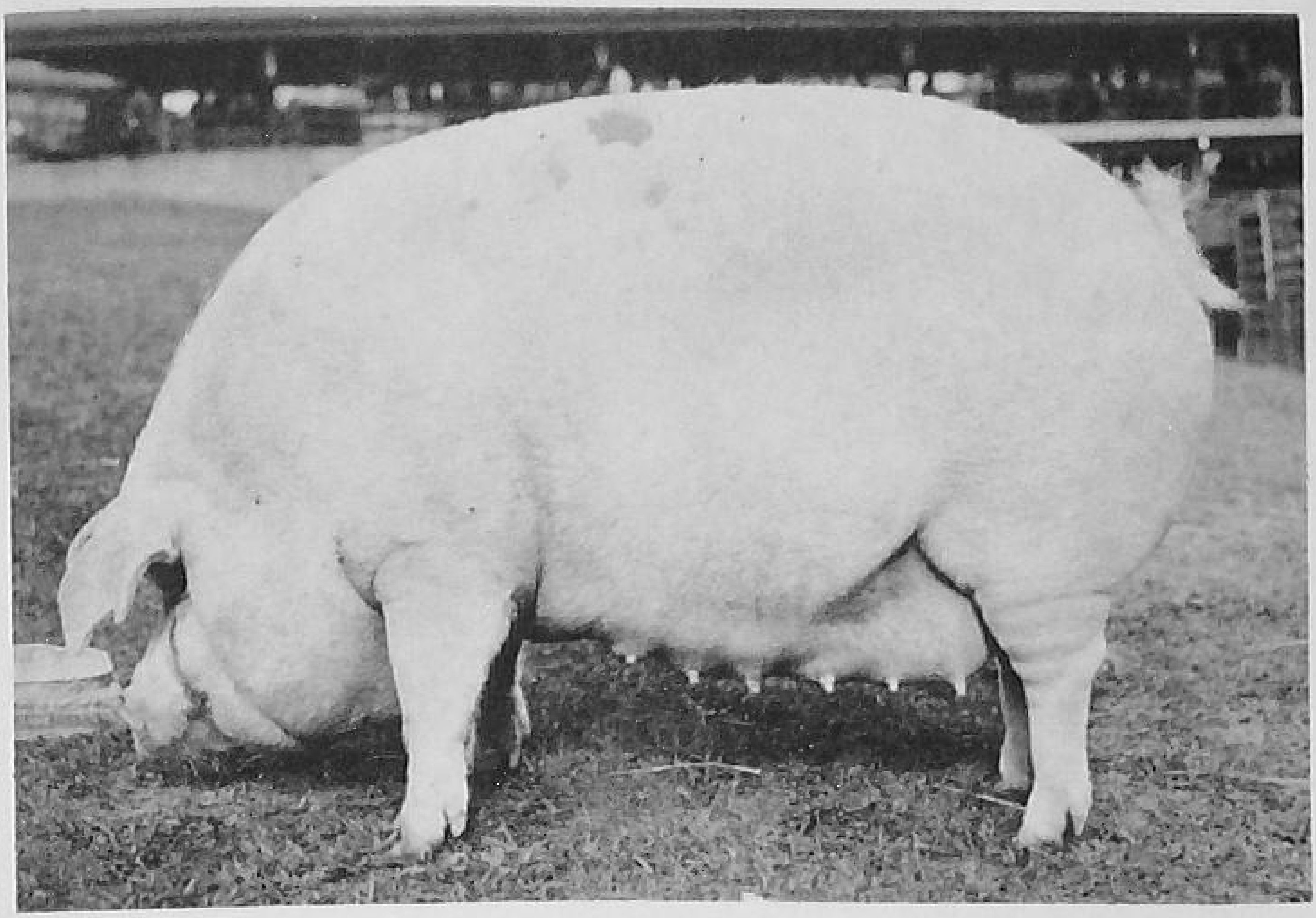


FIGURE 19. *This Chester White sow was Grand Champion at one of the Corn Belt fairs. (Moore photo. Courtesy Chester White Swine Record Association.)*

The Chester White has white hair and skin. Small flecks in the skin are not discriminated against, but black or other than white hair is objectionable. The Chester White is intermediate in size and mature boars weigh 900 pounds and over.

Barrows of the Chester White breed have made excellent records at state and national shows in both on-foot and carcass tests. This breed has been popular with farmers. The sows produce and raise large litters, and the pigs grow out rapidly and make good gains.

There were 18,097 purebred animals registered by the Chester White Swine Record Association in 1952.

Danish Landrace. This breed is native to Denmark, and has been imported to this country for use in crossbreeding. By government agreement we cannot produce and release Danish Landrace stock in this country as purebreds, but we have used them very extensively in crossbreeding. Many of the new breeds of hogs described later in this chapter carry Danish Landrace breeding. In Denmark this breed has been bred and fed to produce some of the best bacon in the world's markets.

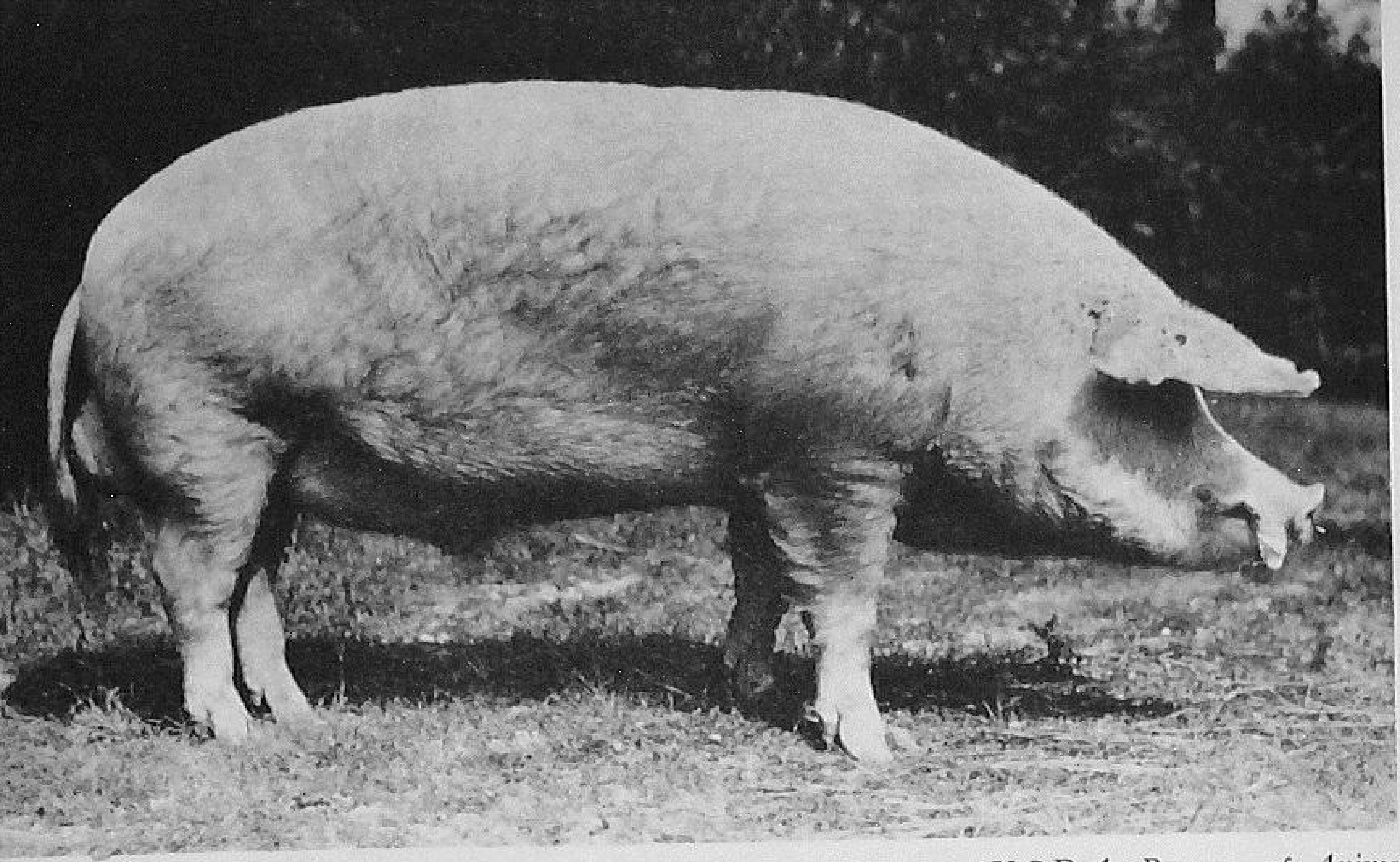


FIGURE 20. *A Danish Landrace boar. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

The Danish Landrace has white hair, and the skin is usually white. Small black spots, however, are common. The breed is extremely long, deep sided, and well hammed. Usually the animals are flat and sometimes low in the back. The ears are very large and cover much of the face. Many of the Landrace breed have weak pasterns. The breed is prolific and efficient in the use of feed.

The carcass of the Danish Landrace is meatier than that of most of our American breeds. There is less backfat and less lard. It produces excellent sides of bacon, hams, and chops. The Black English Landrace has also been used in this country in crossbreeding work.

Duroc. The ancestry of this breed is not entirely known, but the Jersey Reds of New Jersey, the red Durocs of New York, and the red Berkshire of Connecticut have contributed to the formation of the breed. The breed was first called the Duroc-Jersey. Standards were established for the breed in 1885, and although the type has changed several times during the past seventy-five years, the color standards are still adhered to.

The Duroc is red in color, with the shades varying from a golden yellow to a very dark red. A medium cherry red is preferred. Black flecks may appear in the skin, but large black spots, black hair, and white hair are objectionable. In type and conformation, the Duroc is similar to the Chester White and the

Poland China. The breed is prolific, and the sows are good mothers. They have good dispositions, and produce large quantities of milk.

For the year ending November, 1952, there were 81,034 purebred Durocs recorded by the United Duroc Record Association. In 1949, 116,149 animals of this breed were recorded. This number was more than that recorded for the next two most popular breeds, the Hampshire and the Spotted Poland China.

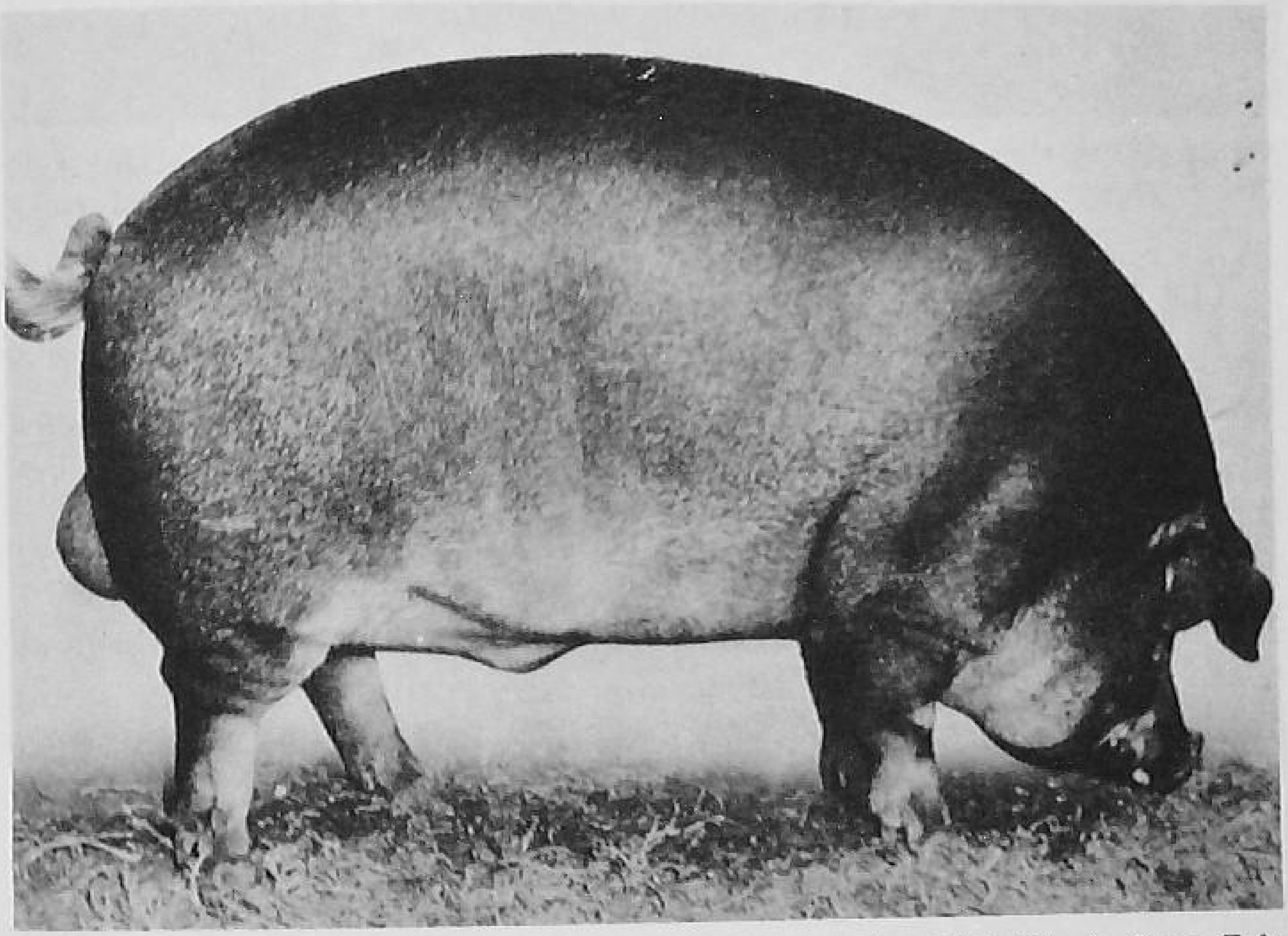


FIGURE 21. *The Grand Champion Duroc boar at the 1952 Illinois State Fair. (Courtesy United Duroc Record Association.)*

The Duroc is large, with excellent feeding capacity and prolificacy. The farmers have found the breed to be excellent for use in crossbreeding programs.

Hampshire. The Hampshire breed was developed in Boone County, Kentucky, from hogs probably imported from England in the early 1800's. The foundation stock was known as the Thin Rinds and Belted hogs, which had been raised in the New England States.

The breed association was organized in 1893, and although the breed is one of the youngest, it has become very popular. In 1952, when 61,670 were recorded, Hampshires ranked second to Durocs in the number of purebred animals.

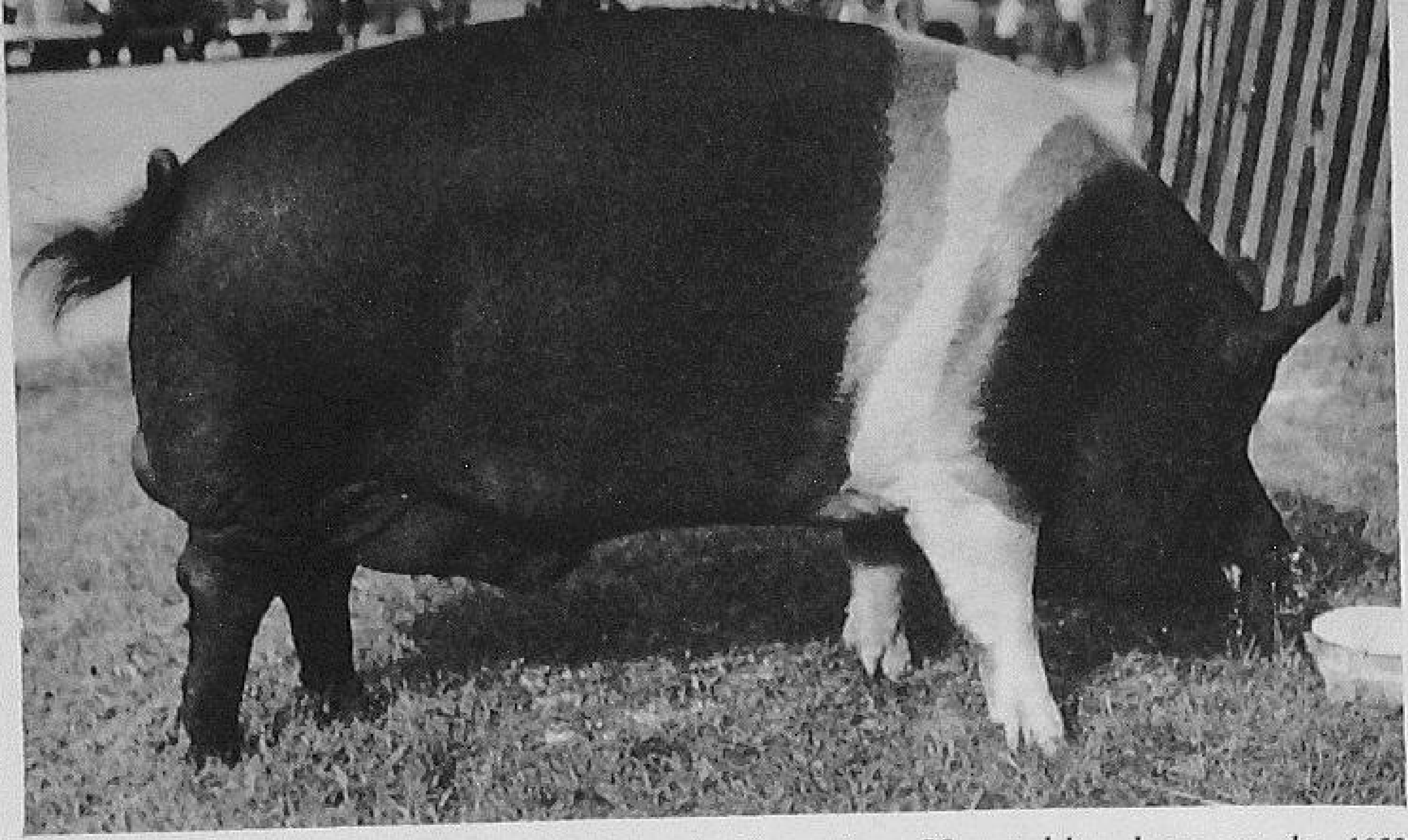


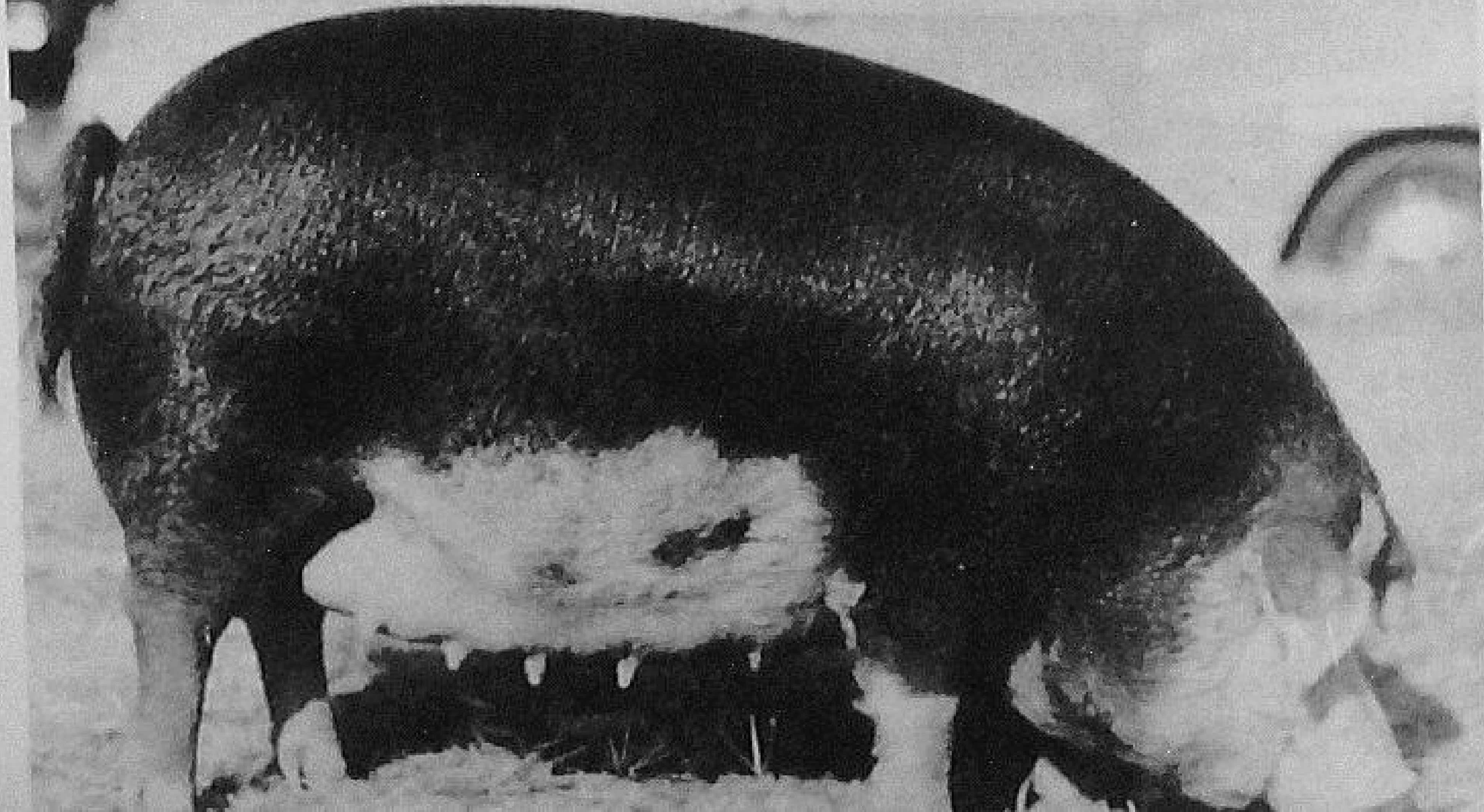
FIGURE 22. *Great Western, the Grand Champion Hampshire boar at the 1952 Illinois State Fair. (Moore photo. Courtesy* American Hampshire Herdsman.)

The Hampshire is a black hog with a white belt encircling the body and including the front legs. The back legs are usually black, and no white should appear above the hock. The head and tail are black, and the ears are erect. No white can appear on the head.

The Hampshire is smaller than some of the other meat-type breeds. It has been bred for refinement, quality, and prominent eyes. The sows of the breed are very prolific and are good mothers. The Hampshire is a good rustler and does well on pasture and following cattle in the feed lot.

It is usually shorter legged than are most breeds and sound on its feet and legs in most cases. The breed has been used extentively in crossbreeding because of its quality, fleshing, and prolificacy.

FIGURE 23. *A Hereford sow. (Hereford Photos, Inc. Courtesy National Hereford Hog Record Association.)*



Hereford. This breed was originated about 1900 by R. U. Webber of La Plata, Missouri. He used Durocs, Chester Whites, and OIC Chester Whites in founding the breed. The first registry association was formed in 1920, and the present National Hereford Hog Association was formed in 1934.

The ideal markings for a Hereford are a white head (including the ears), feet, underline, and switch of tail. The remainder of the body is red. The red varies from light to dark with the darker shades preferred. At least two-thirds of the Hereford must be red.

In 1952, there were 3,841 purebred Herefords recorded. Considerable use of this breed was made in crossing during World War II. The color markings are similar to those of Hereford cattle.

OIC. This breed was originated by L. B. Silver in Ohio about 1865 from foundation stock obtained in Chester and Delaware counties in Pennsylvania, the same counties which produced the Chester White breed. The breed was first called the Ohio Improved Chesters. The OIC Swine Breeders Association, Inc., was organized in 1897.

The OIC breed resembles the Chester White in color. The sows are good mothers and milkers.

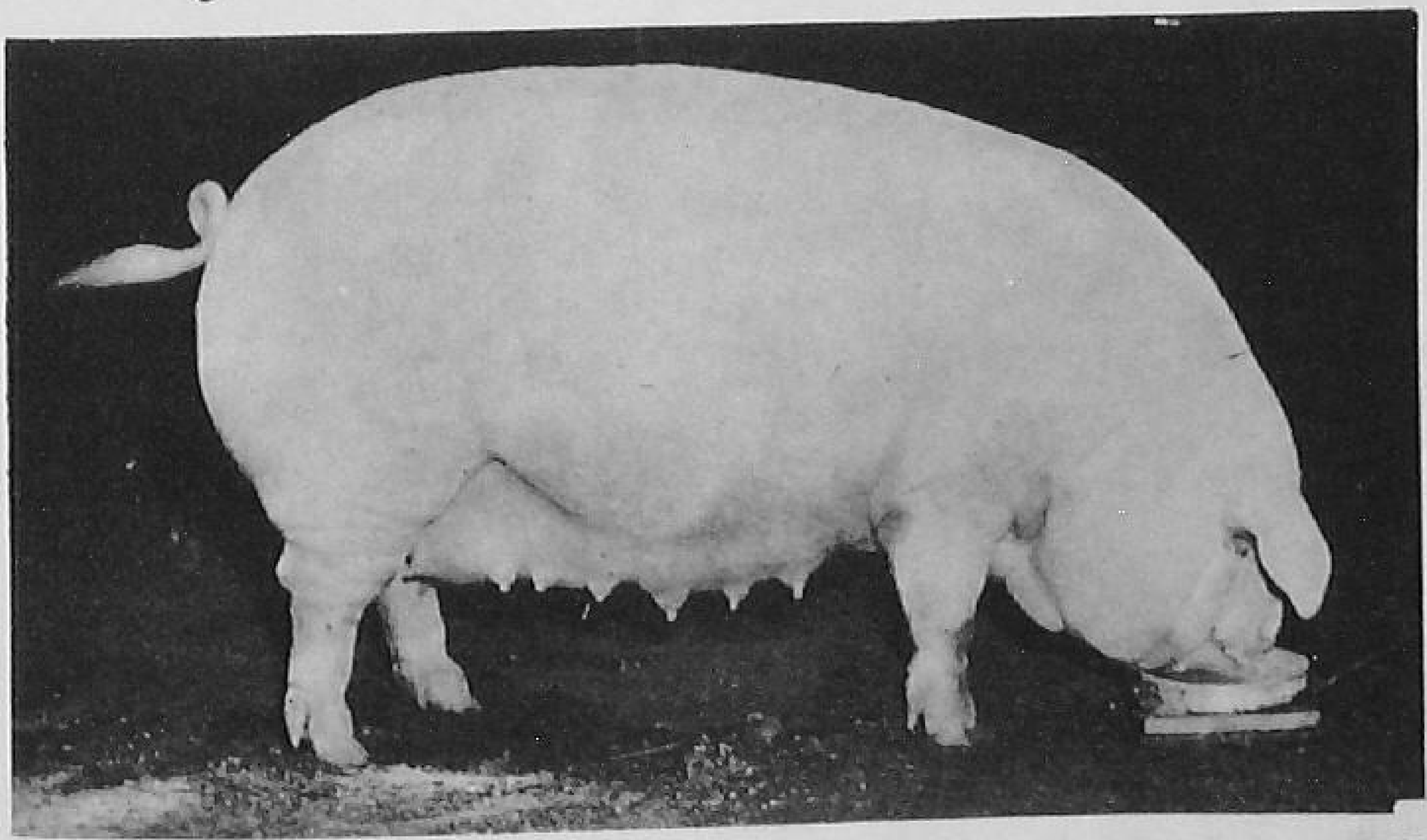


FIGURE 24. *A mature sow of the OIC breed. (Moore photo. Courtesy OIC Swine Breeders' Association, Inc.)*

In 1952 there were about 6,000 OIC's recorded. During that year there were 25,638 Chester Whites recorded. The OIC breed

has been quite popular in certain sections of the eastern Corn Belt.

Poland China. For many years the Poland China has been considered the largest of the American breeds. Today it is similar in size, type, and conformation to the Duroc, Chester White, and Spotted Poland China.

The breed was originated between 1800 and 1850 in Warren and Butler counties in Ohio. The white Byfield hog, imported from Russia, and the White Big China hog were used with native hogs in producing the Warren County Hog. The use of the Berkshire on the Warren County Hogs and later the use of boars imported from Ireland produced the Poland China breed.

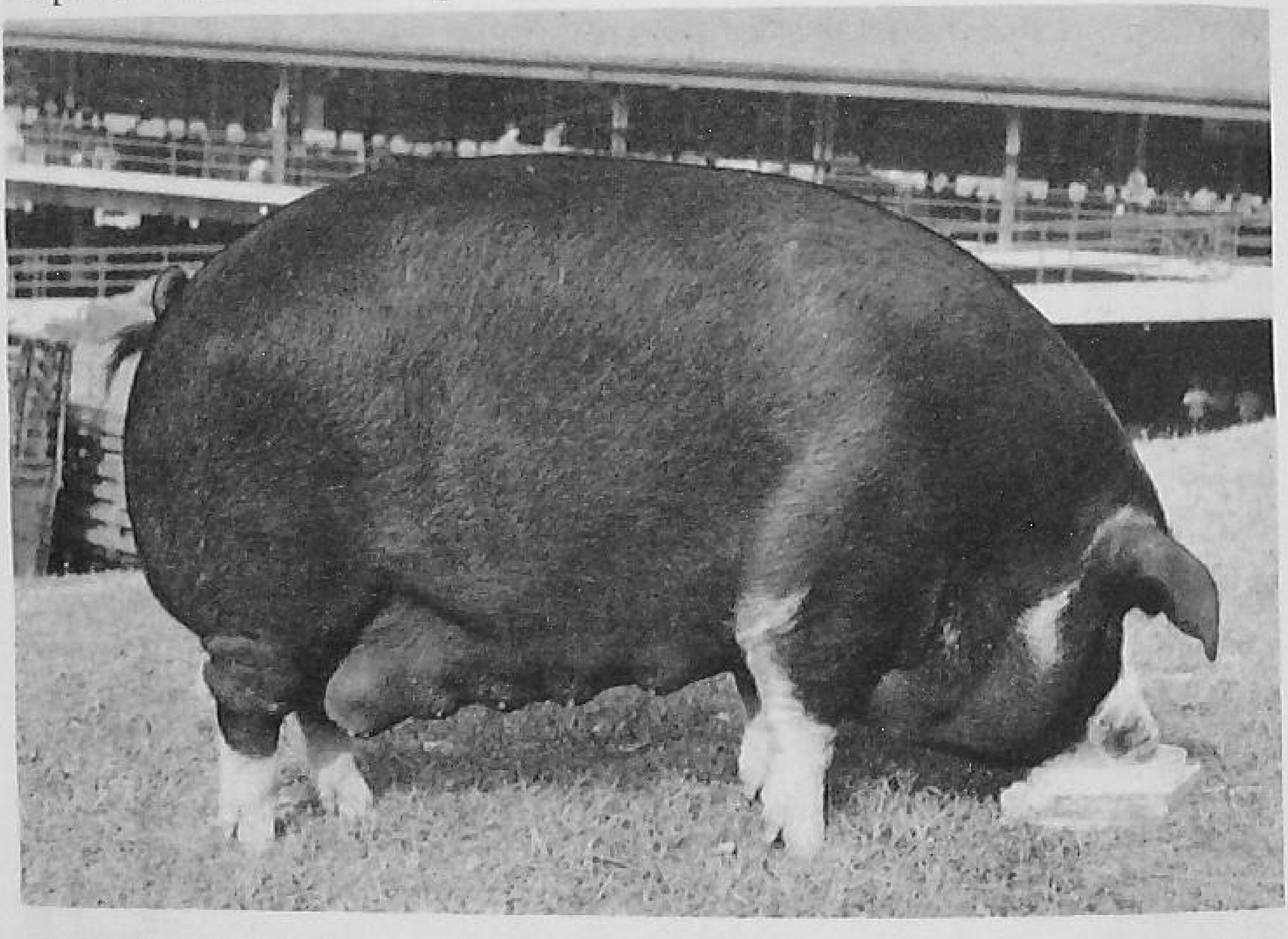


FIGURE 25. *This Poland China sow was Grand Champion at the Illinois State Fair. (Moore photo. Courtesy* The Poland China World.)

Since about 1875, the Poland China has been a black hog with six white points, the feet, face, and tip of tail. Mature boars weigh up to 1,000 pounds. The typical Poland China has thick, even flesh and is free from wrinkles and flabbiness. The breed has good length and excellent hams. The head is trim, and the ears are drooping.

Poland Chinas produce excellent carcasses. Barrows of this breed have been popular winners in both on-foot and carcass contests.

There were 21,445 Poland Chinas recorded in 1952. The sows

of this breed are good mothers, but the breed has been best used in crossbreeding. The Poland China crosses excellently with the Duroc, Hampshire, and Chester White.

Spotted Poland China. Early in the development of the Poland China breed, many of the hogs were spotted, and some breeders preferred this color. They were reluctant to adhere to the color standards set up for the Poland China breed, and many continued to grow spotted hogs. Some of these hogs were crossed with the black Poland China and some with Gloucester Old Spots which had been imported from England.

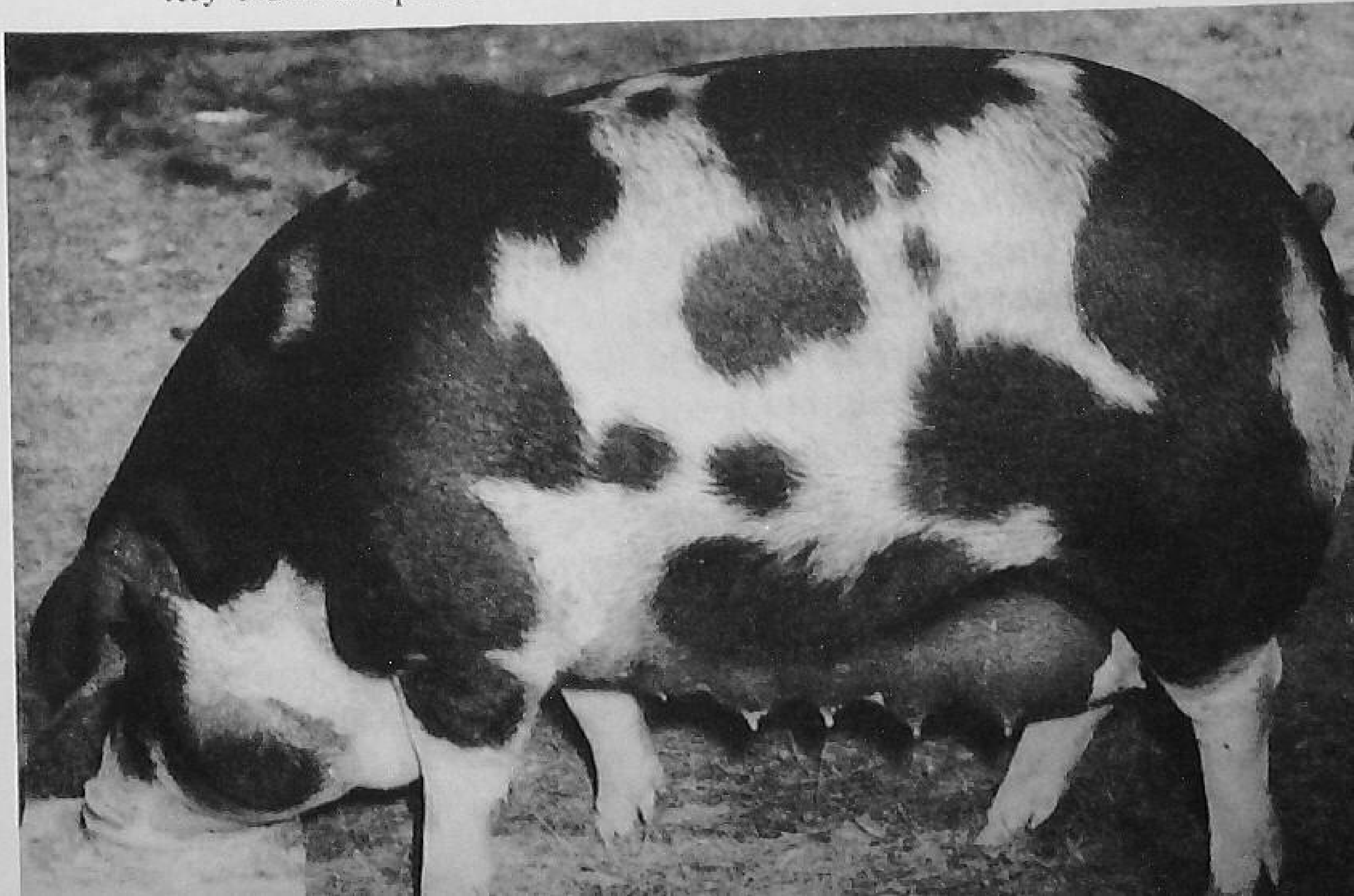
The formation of the National Spotted Poland China Record Association came about in 1914.

As shown in Figure 26 the Spotted Poland China resembles the Poland China in type and conformation. It is a large breed, and the animals are good feeders. To be eligible for registration the color on the body must be between 80 and 20 per cent white, but the desired color is 50 per cent black and 50 per cent white.

This comparatively new breed has become very popular. In 1952 the breed association recorded 28,374 animals, the third largest number recorded by any breed association during that year.

Tamworth. The Tamworth is red in color, with the shades varying from light to dark. The head is long and narrow, with a long snout and erect ears. The body is also long and narrow, and

FIGURE 26. *This Spotted Poland China sow was a 1952 Grand Champion. (Courtesy* National Spotted Poland China Record and Bulletin.)



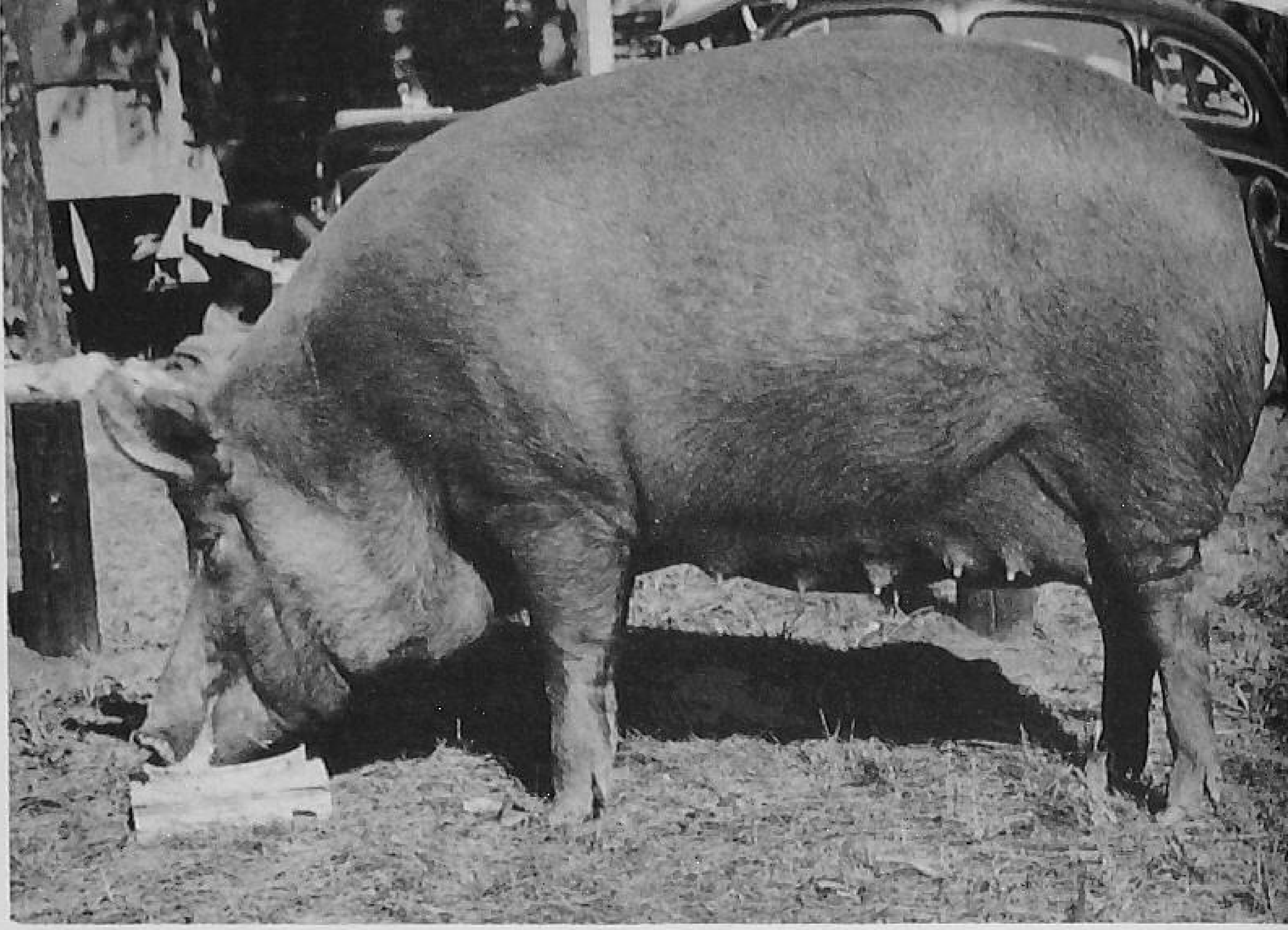


FIGURE 27. *The Champion Tamworth sow at the 1950 Iowa State Fair. (Moore photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

the sides are smooth. Usually the Tamworth has a strong back and thin shoulders. The carcass produces bacon of the best quality.

Sows of this breed are prolific and are excellent mothers and foragers. Mature boars weigh up to 700 or 800 pounds. In 1952, 3,926 purebred animals were recorded. Since World War II the breed has become more popular for use in crossbreeding because commercial producers and packers want to decrease lard production. Tamworth bloodlines were used in producing the Minnesota No. 1 breed of swine.

Yorkshire. This breed is considered by many as the best bacon breed. It is raised in large numbers in Canada, England, Scotland, and Ireland. It is a native breed of Northern England, and was imported to this country early in the nineteenth century. It has never been one of the most popular breeds. Most herds have been developed in the northern states.

The Yorkshire is extremely long and deep and is firm fleshed. It is a white breed, but small black spots may appear in the skin. No black hair is permitted in recording animals. As shown in Figure 28, the Yorkshire has very large, erect ears. Slaughter animals yield a high dressing percentage and best bacon quality.

Nearly 50,000 Yorkshires have been recorded during the past four years. The breed has become popular in crossing to reduce lard and to increase the quality of carcass. About as many York-

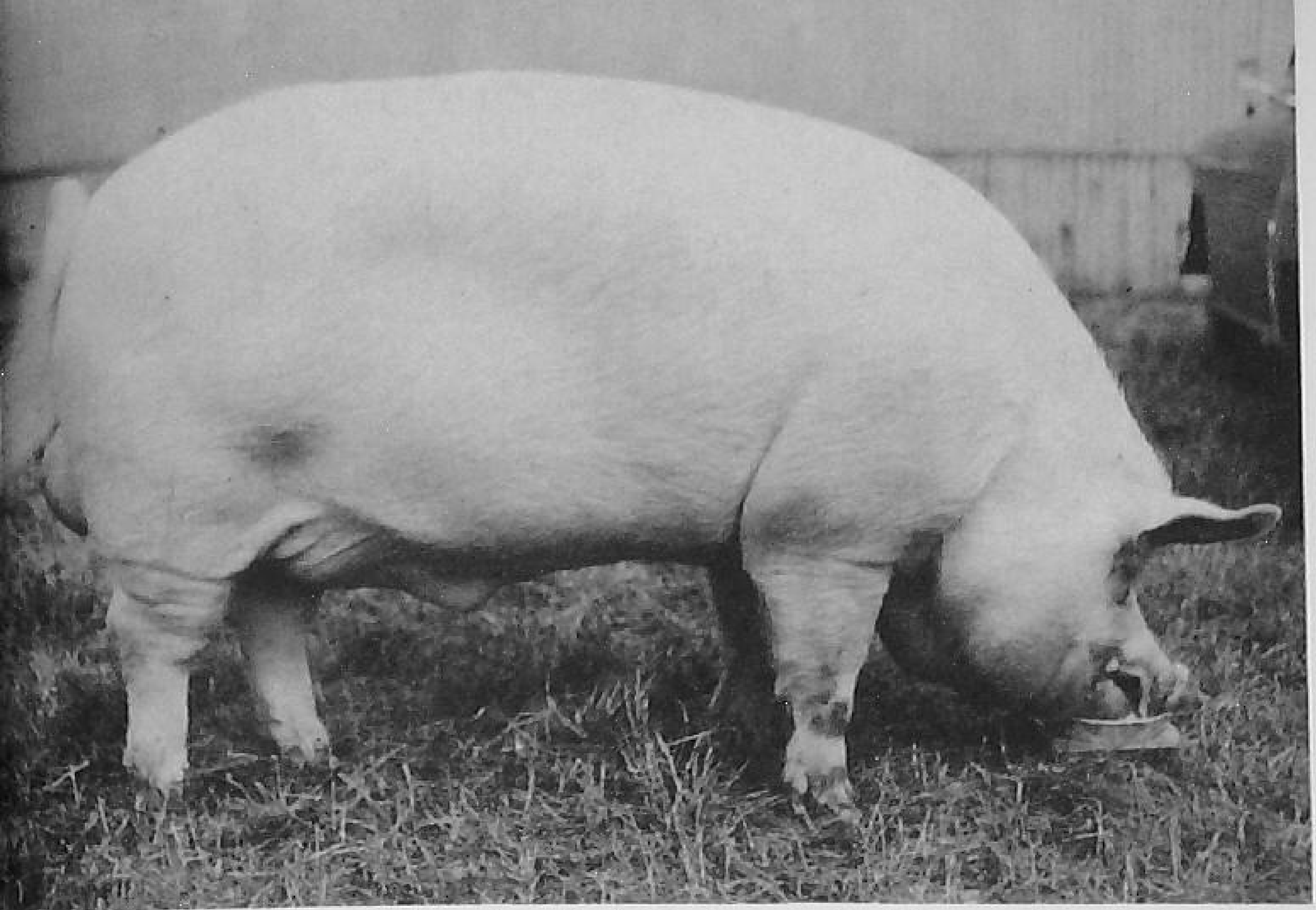


FIGURE 28. *Grand Champion Yorkshire boar at the 1952 Iowa State Fair. (Moore photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

shires were recorded during the past four years as had been recorded during the preceding fifty years. There were 10,679 Yorkshires recorded in 1952.

New breeds developed from inbred lines. As pointed out previously, a number of new breeds have been developed. Most of these breeds have had their origin at the U.S.D.A. Agricultural Research Center at Beltsville, Maryland, at the Regional Swine Breeding Laboratory at Ames, Iowa, or at cooperating state agricultural experiment stations. Table 7 gives a list of some of the most promising new breeds. This information has been supplied by Mr. J. H. Zeller of the Agricultural Research Center at Beltsville, Maryland.

In the development of these new breeds, an attempt has been made to produce an animal which possesses the desirable characteristics of the two parent stocks. The bacon-type breeds, the Danish Landrace, Yorkshire, and Tamworth, have been used in various combinations with the meat- or lard-type breeds. The growing and gaining ability and the ruggedness of the meat-type breeds, and the carcass quality of the bacon-type hogs were desired in developing the new breeds. With the exception of the Minnesota No. 1, the new breeds involved the crossing of meat- and bacon-type breeds. The Minnesota No. 1 involved the crossing of the Danish Landrace and the Canadian Tamworth.

TABLE 7

THE NEW BREEDS DEVELOPED FROM INBRED LINES

Breed Name	*Per Cent of Blood*		*Color*	*In Cooperation with*	*Registered by*
Minnesota No. 1	55	Landrace	Red	University of Minnesota	Inbred Livestock Registry Association
	45	Canadian Tamworth			
Minnesota No. 2	40	Canadian Yorkshire	Black with White Spots		
	60	Inbred Poland China			
Montana No. 1 (or Hamprace *) Hamprace	55	Landrace	Solid black	Montana Agricultural Expt. Station	Hamprace Swine Breeders Association
	45	Black Hampshire (same)	(same)		
Beltsville No. 1	74	Landrace	Black with White Spots	At Beltsville	Inbred Livestock Registry Association
	26	Poland China			
Beltsville No. 2	58	Danish Yorkshire	Light Red	At Beltsville	
	30	Duroc			
	6	Landrace			
	6	Hampshire			
Maryland No. 1	63	Landrace	Black with White Spots	University of Maryland	
	37	Berkshire			

* Montana No. 1 or Hamprace from the same origin, developed at Miles City, Montana.

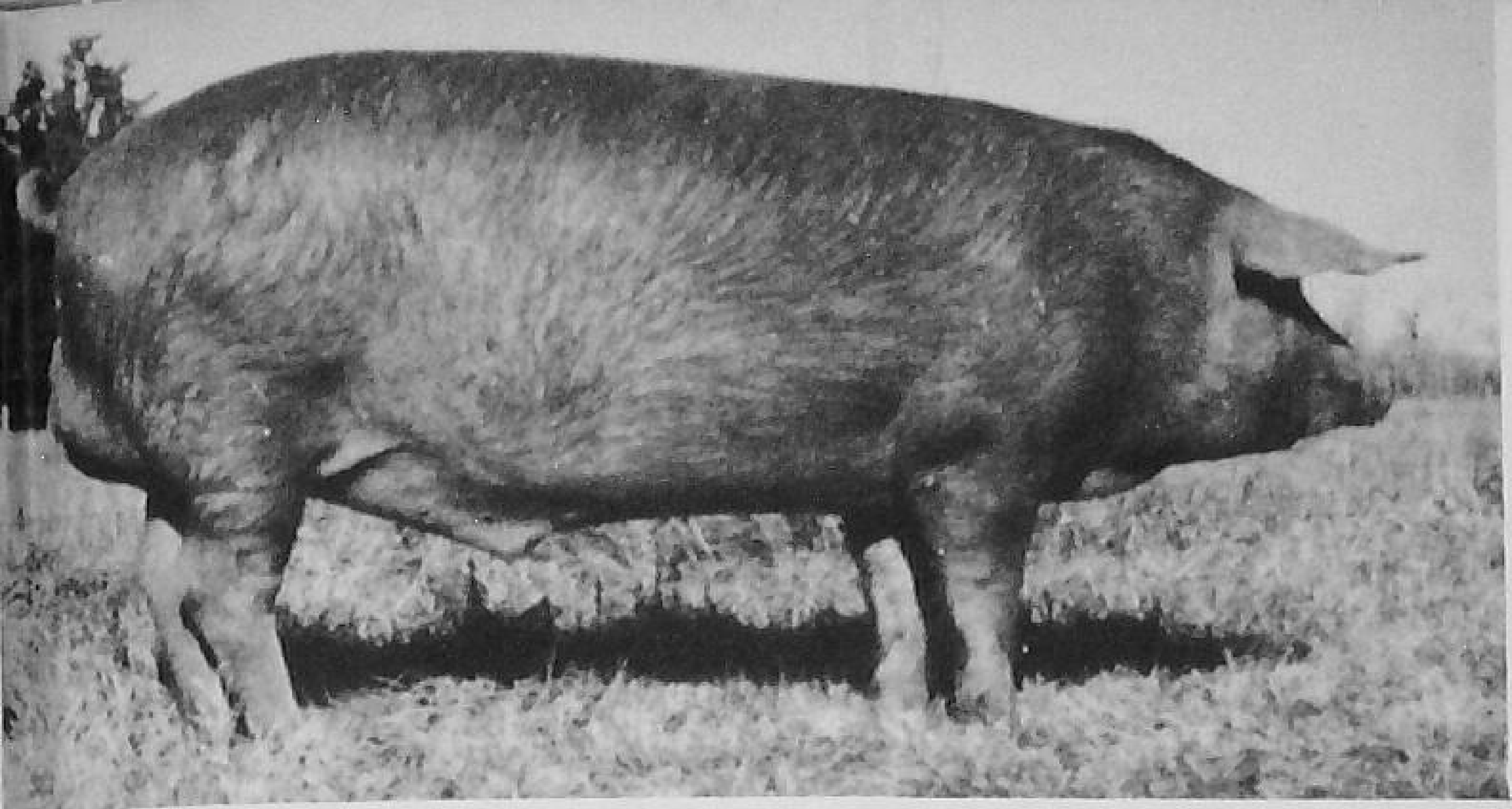


FIGURE 29. *A Minnesota No. 1 boar (Landrace X Tamworth). (Courtesy U.S.D.A. Bureau of Animal Industry.)*

With the exception of the Minnesota No. 2, all of the new breeds carry Danish Landrace breeding. The new breeds carry the added length, the plumpness of hams, the trimness of head, and the carcass quality of the Landrace, but have the color, ruggedness, and in part, the body conformation of the American breeds. The Danish Landrace has a very thin skin and is subject to sun scald in hot weather. Through crossing of the breeds it has been possible to produce black and red strains, combining the qualities of both the Danish Landrace and the American breeds.

FIGURE 30. *Beltsville No. 1 boar (Landrace X Poland China). (Courtesy U.S.D.A. Bureau of Animal Industry.)*

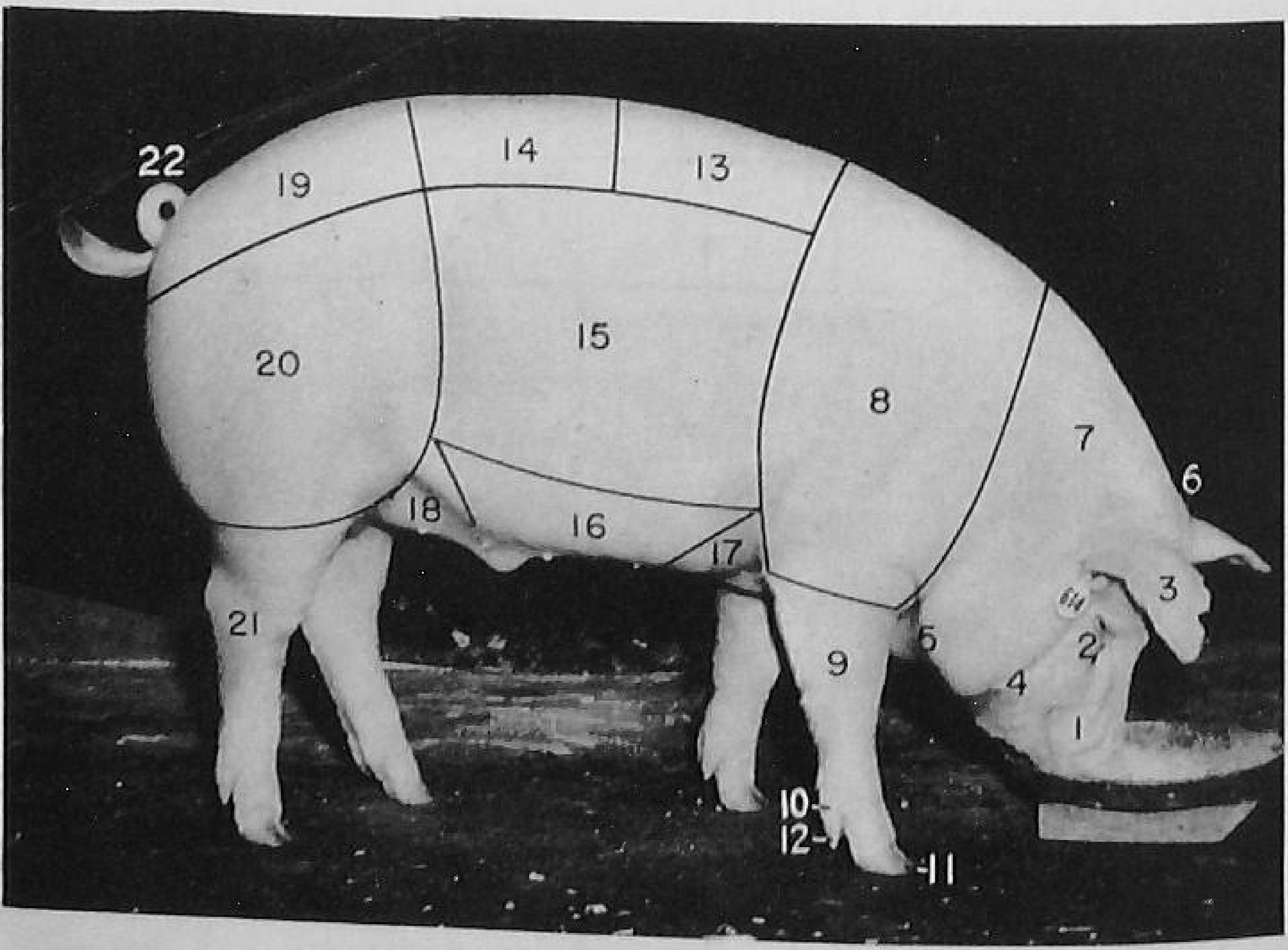
The inbred Livestock Registry Association of St. Paul, Minnesota, records the pedigrees of the new breeds of swine. A total of 18,665 animals were recorded up to 1952. They represented the following breeds:

Minnesota No. 1	14,825	Minnesota "G" Line	58
Minnesota No. 2	2069	Beltsville No. 1	31
Montana No. 1	1547	In-cross	125
Maryland No. 1	65		

This association recorded 2952 pedigrees in 1951.

Fairly large numbers of boars of the new breeds produced from inbred bloodlines have been used by commercial pork producers. In most cases they have been used in a rotation system of breeding. The breeds included in the rotation are usually our present-day purebred breeds, together with the new breeds. Some growers, however, are using three or four of the new breeds in rotation. Care must be taken in the selection of breeds to be certain that they nick. Crosses between the Beltsville No. 1, the Hamprace, and the Duroc give evidence of being one of the good combinations for rotation breeding.

FIGURE 31. *Parts of a hog.* (1) *snout,* (2) *eye,* (3) *ear,* (4) *cheek,* (5) *jowl,* (6) *poll,* (7) *neck,* (8) *shoulder,* (9) *foreleg,* (10) *pastern,* (11) *toes,* (12) *dew claw,* (13) *back,* (14) *loin,* (15) *side,* (16) *belly,* (17) *fore-flank,* (18) *hind-flank,* (19) *rump,* (20) *ham,* (21) *hind leg,* (22) *tail.* *(Abernathy photo. Courtesy Chester White Swine Record Association.)*



SELECTION OF INDIVIDUAL BOARS AND SOWS

The factors to be considered in selecting boars and sows for the breeding herd are much the same regardless of the breeds and breeding programs which are involved. It has already been mentioned that the differences among the animals of one breed may be as great or greater than the differences between breeds. It is very important that hog producers select carefully the animals which are to be used in the breeding herd because it is difficult to grow hogs profitably when inferior breeding stock is being used.

Parts of a Hog. Farmers, breeders, and packers use much the same terms in describing hogs. Since these terms will be used repeatedly in the following paragraphs, the reader should become familiar with them. Figure 31 shows the various parts of the body of a Chester White barrow.

The Ideal Type and Conformation. Breeders of purebreds and commercial pork producers usually have some ideal in mind in selecting breeding and feeding stock. Usually they do not find animals which possess all the characteristics that they are looking for, and must select those which are nearest their ideal. Not all breeders and feeders agree about what makes up the ideal type and conformation of a hog. Breeders and farmers at a purebred boar sale will select different boars as their ideal.

The ideal type changes from time to time with changes in market demands. More attention is usually given to quality of carcass when hogs are plentiful than when hogs are grown in smaller numbers. Factors associated with prolificacy may be given more emphasis when the price of pork is high than when pork is cheap.

Producers select animals to be mated with other animals. Quite often the animal selected is not the ideal in several respects, but it is sufficiently outstanding to mate well.

Ideal type of market hog. The ultimate goal in all hog production is to produce efficiently and profitably a hog which will yield when slaughtered a carcass high in the cuts of pork desired by the consumer. The Duroc barrow shown in Figure 32 is considered by many to approach the present-day concept of the ideal meat-type hog. For illustrative purposes a similar animal could have been selected from each of the other meat-type breeds. It is the goal of the farmer and hog breeder to select breeding stock which will produce market hogs with the muscling, conformation, and carcass quality possessed by this barrow.

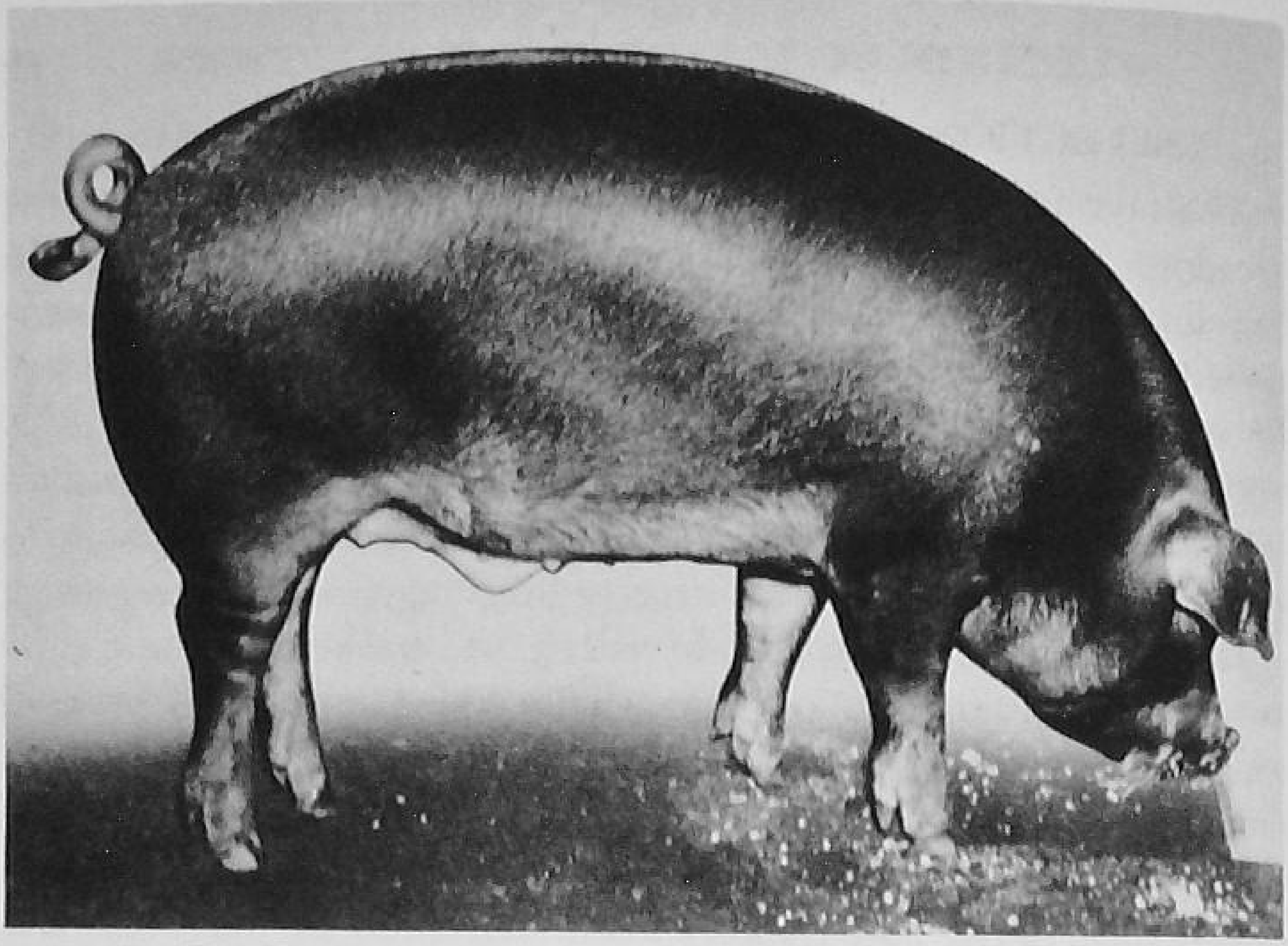


FIGURE 32. *The Grand Champion barrow over all breeds at the 1952 Illinois State Fair. (Courtesy United Duroc Record Association.)*

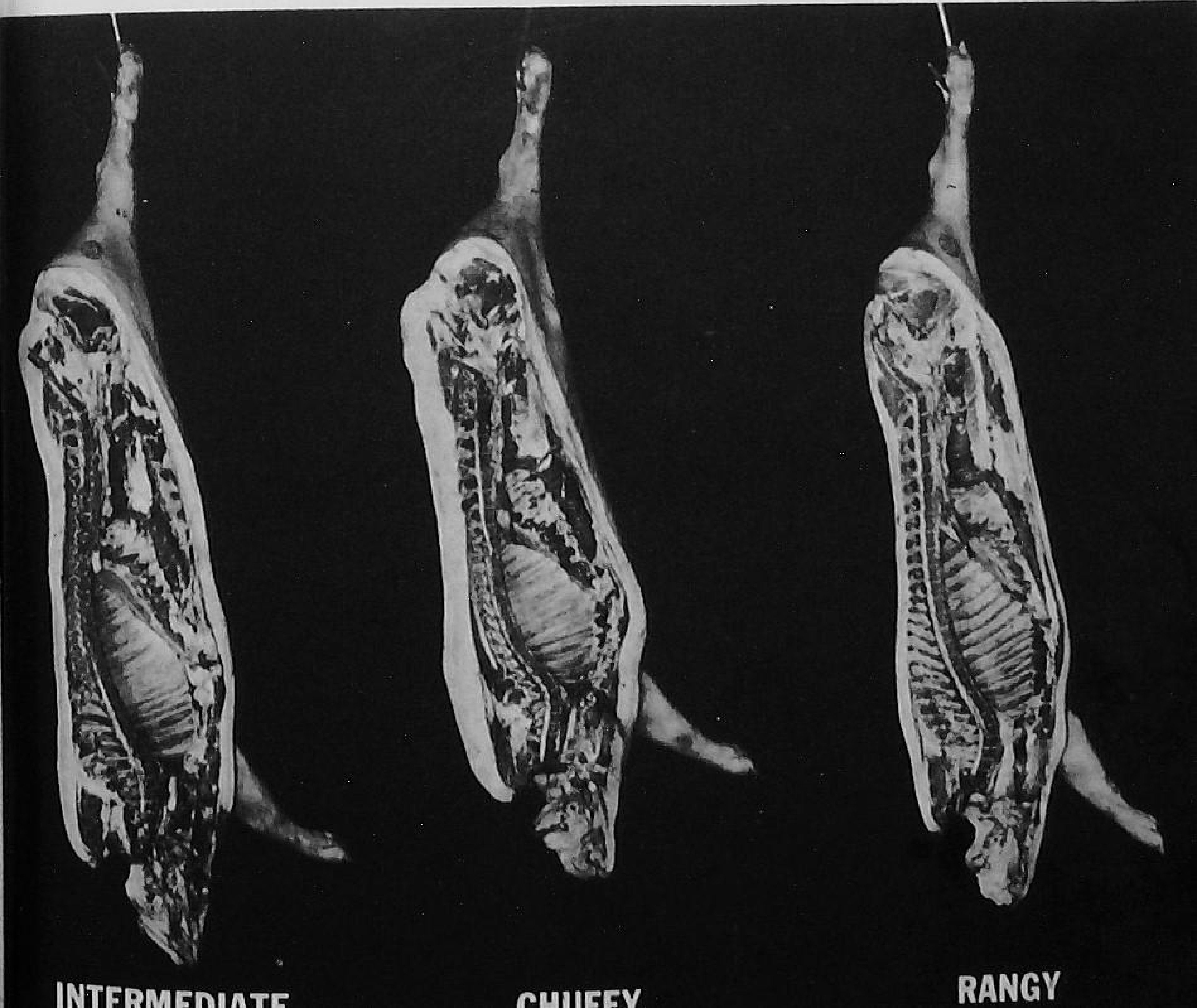
This barrow has good length and width of body. He carries his depth uniformly from front to rear, and he is deep and smooth sided. He is especially good in the ham. Note the plumpness and depth of ham. This barrow gives evidence of being firm fleshed. There are no signs of flabbiness and he is well muscled, with a trim head and jowl.

Swine growers are very anxious to produce market pigs which will dress out well when slaughtered. This barrow should produce an excellent carcass and yield a 73 per cent dressing percentage or better. Dressing percentages refer to the percentage of the live weight of the hog found in the carcass after the animal has been slaughtered. Lard-type or exceedingly fat hogs may yield dressing percentages of 75 per cent or more. We desire in the meat-type hog a carcass with a high dressing percentage, but also a carcass high in the choice cuts: ham, loin, Boston butt, and picnic shoulder. This barrow should produce a high percentage of lean cuts and a minimum of backfat and lard. He is the kind of pig which can be ready for the market when weighing from 210 to 225 pounds. The carcasses of three barrows of different types are shown in Figure 33. The carcass on the left is from the intermediate or meat-type hog. It is the type of carcass which we would expect to get from the barrow pictured in Figure 32. Note the thickness of the layer of fat over the back and compare it with

the backfat on the carcass in the center, which is from a chuffy hog. There is nearly twice as much backfat on the carcass from the chuffy hog as there is on the carcass from the intermediate hog. It has been found that the percentage of lean cuts in a carcass is closely related to the backfat thickness. Lard is cheap, and the housewife demands lean meat. It is the responsibility of the breeders of both purebreds and commercial hogs to select breeding stock which will produce heavily muscled carcasses low in lard content.

The carcass on the right is from a rangy barrow. It has a very thin layer of backfat, but the ham and loin are undeveloped. A higher percentage of the carcass is in the form of bone and skin. Usually rangy hogs require more time in being finished for market, and they are marketed at heavier weights. The cuts from rangy hogs are not as pleasing to the consumer and usually sell for less

FIGURE 33. *Carcasses of hogs intermediate, chuffy, and rangy in type. Note the differences in length, meatiness, and backfat thickness. (Courtesy Wilson & Co.)*



per pound than do the cuts from the intermediate or meat-type carcasses.

Today the ideal market hog is the intermediate, middle-of-the-road, meat-type hog. Breeders and packers shy away from both the chuffy and the rangy animals. The chuffy hog produces too much backfat and lard; the rangy hog requires too much time to be properly finished and produces a heavy carcass.

Ideal type of breeding animal. Now that we know which type of market hog we want to produce, we can determine the type, conformation, and other qualities desired in the boars and sows which will produce this kind of pig. The kinds of feeds fed and the methods of feeding also influence the growth rate, the economy of gain, and the quality of the carcass produced. Good feeding practices are of little value unless we have the right kind of breeding stock to begin with.

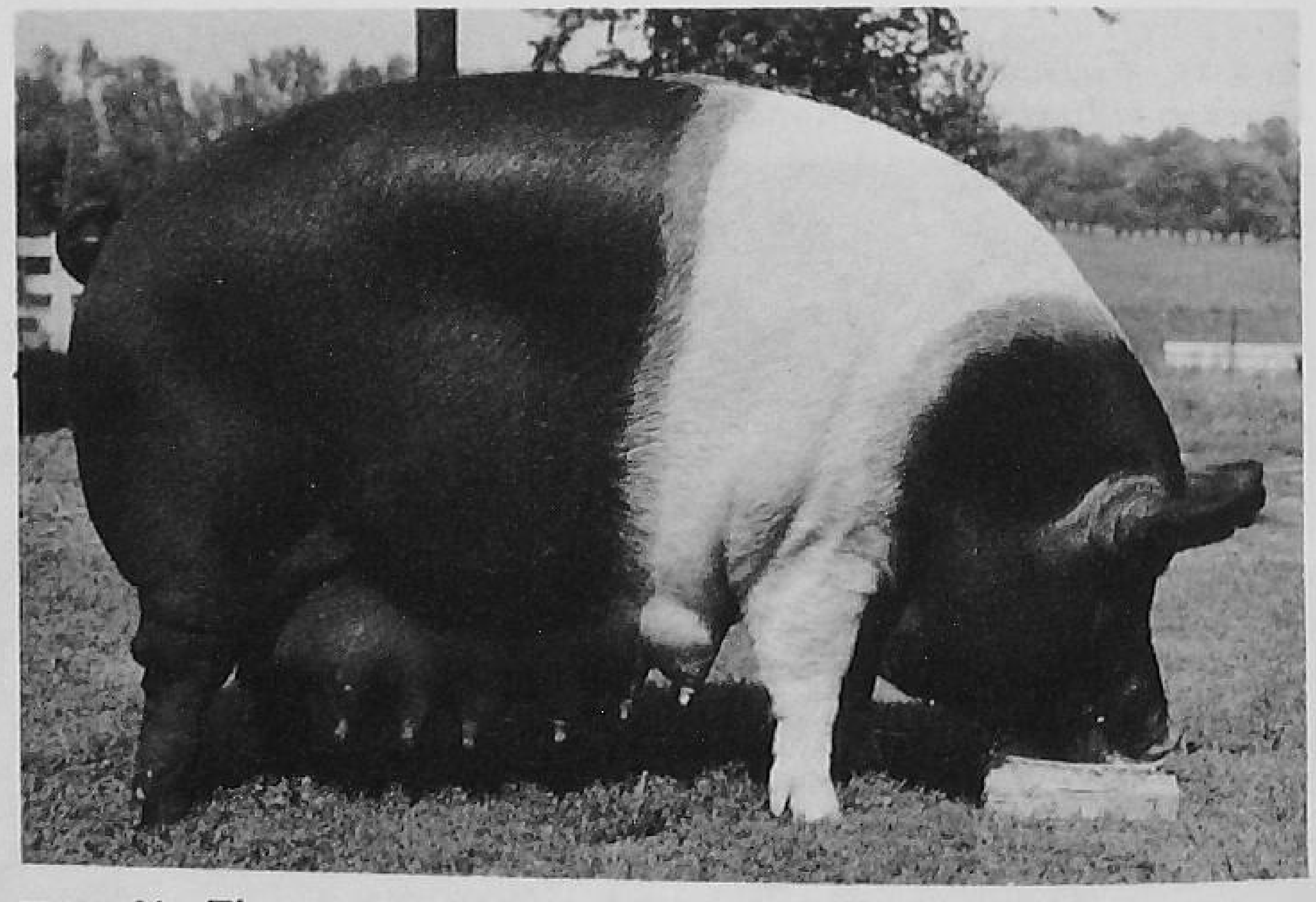


FIGURE 34. *The 1951 All American Senior Yearling Hampshire Sow.* (Courtesy American Hampshire Herdsman.)

The mature sow shown in Figure 34 possesses many of the characteristics desired in a brood sow. She has a medium-long body and a strong, well-arched back. She is deep sided and has the capacity of the chest and middle that insures good feeding quality and vigor. Note her well-developed, deep, and full hams. This sow is good on her feet and legs. She has ample bone, strong

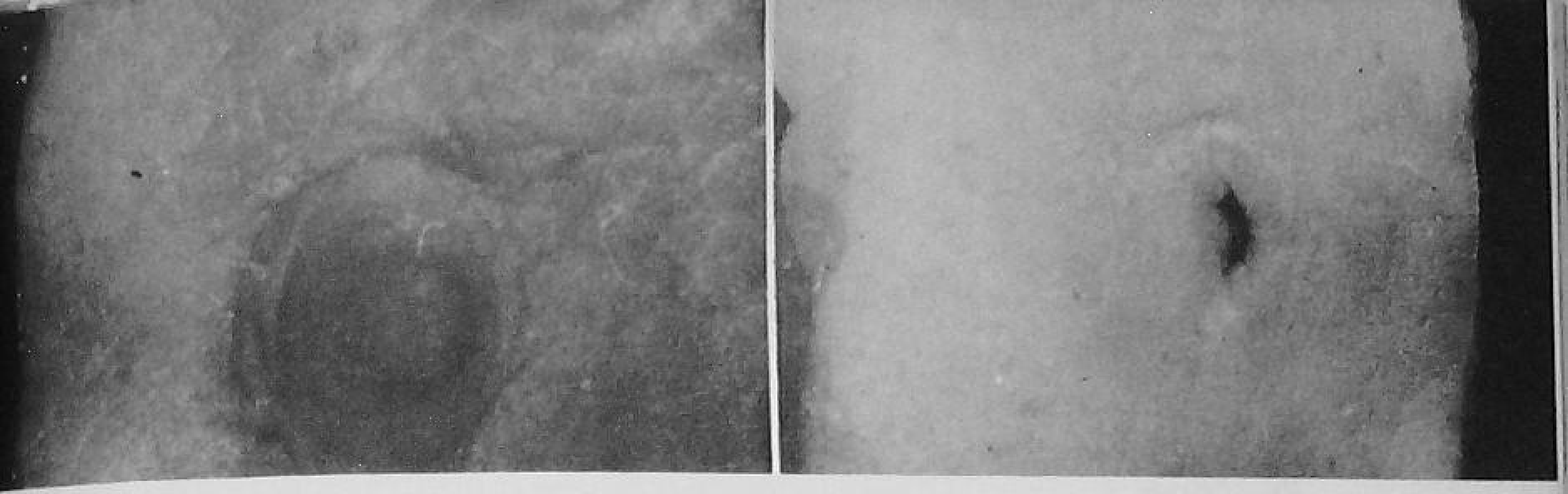


FIGURE 35. *(left) Normal nipple. (right) Inverted nipple. (Courtesy Dr. Roy M. Kottman, Department of Animal Husbandry, Iowa State College.)*

but medium-length legs, and short, straight pasterns. A brood sow must have good feet and legs; an inactive or clumsy sow usually is unable to raise a good litter.

This sow has a trim head and jowl. She is feminine and has a prominent eye. Coarse-headed and heavy-jowled sows should not be kept in the herd. Femininity and a reasonable amount of refinement are desirable in brood sows.

This brood sow is smooth in the shoulders, has a wide, well-muscled loin, and has an excellent hair coat. The refinement of the head and ear, shoulder, and hair coat are important items in selecting female herd material.

The udder of the sow should be well developed with ten, twelve, or fourteen sound teats. The teats should be prominent and well spaced. The sow shown in Figure 34 has an excellent udder.

Bidders on boars and gilts in purebred sales usually inspect the teats or rudimentaries on the animal being sold. The teats on boars are called *rudimentaries* or *rudimentary teats.* Sometimes a teat on a sow is not connected with a milk gland and will not produce milk. This is called a *blind teat.* A teat which has an inverted nipple is more serious. These teats usually do not come down and produce milk. A sow with ten teats can suckle only seven pigs if she has three blind teats or inverted nipples. Boars and sows will pass this characteristic on to their offspring, so it is important that all breeding stock have sound underlines. Figure 35 shows a normal and an inverted nipple.

The boar shown in Figure 36 has much the same conformation as that possessed by the Hampshire sow. We like ruggedness in a boar. He needs an especially good strong back and straight, heavy-boned legs. A boar must be active. The same body conformation desired in brood sows is desired in boars. This Chester White boar is an excellent young herd boar prospect.

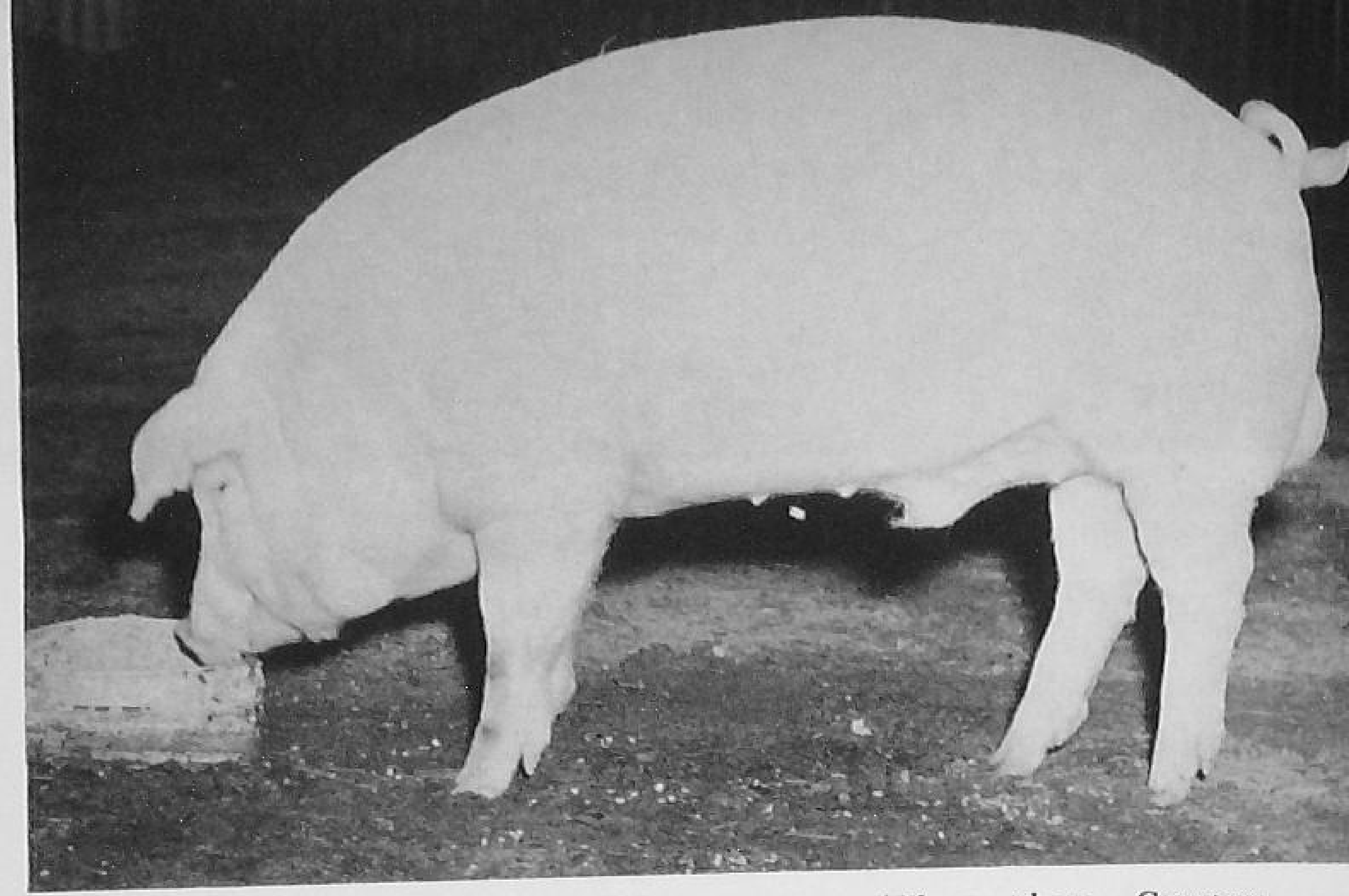


FIGURE 36. *An outstanding young herd boar prospect. (Moore photo. Courtesy Chester White Swine Record Association.)*

Other Factors in Selecting Breeding Stock. Although type is important, it is just one of a number of factors which should be considered in selecting breeding stock. In selecting both boars and gilts, age, pedigree, performance or production records, health, and disposition should be given consideration.

Age. The use of boars and sows which have proven themselves as producers eliminates the risk encountered in using untried animals. Mature sows usually produce more and larger pigs per litter than do gilts, and are usually better milkers. However, they become large and heavy, and more clumsy than gilts. They require more feed to maintain themselves and need larger farrowing pens. Mature boars usually settle more sows and are more dependable during the breeding season. They do not get the "flu" as easily as do young boars, and they are usually in better health during the breeding season.

Most farmers and breeders, however, use young boars and gilts in their breeding operations. The young animals require a smaller investment, need less feed to maintain themselves, and need less space in housing. When a young animal dies, there is less loss than there is when a mature animal is lost. The young animal gains in weight during the production period, and can be sold at a good price after it is no longer useful in the herd.

Pedigree. Every animal has a pedigree, but only the pedigrees of purebred animals can be recorded by a breed association. A

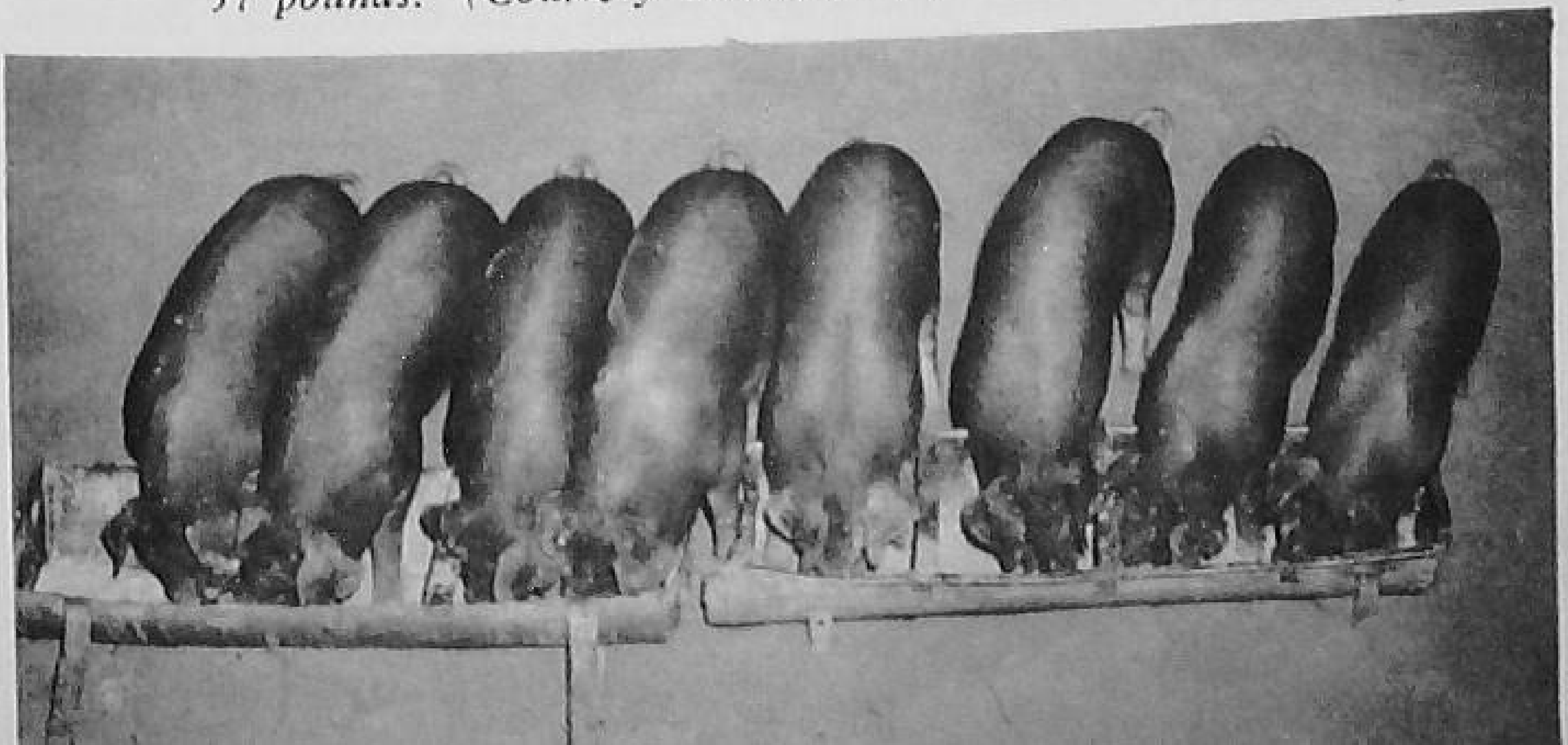
pedigree is merely a record of the bloodlines of the ancestors of the animal. The pedigree is very important in the breeding of purebreds, but the breeder of commercial hogs is more concerned with the production record of the sire and dam of the litter than with their pedigrees.

Performance or production records. It is possible to judge the performance of a mature animal by the size of the litters produced, by the conformation of the pigs, and by the weight of the pigs at 56 days or at 150 to 180 days of age. Most breeders prefer breeding stock from litters of eight or more pigs raised. They want the pigs to average 35 to 40 pounds at 56 days, and 200 to 225 pounds at 5 or 5½ months of age. By ear-marking the pigs at birth and weighing them at 56 days, or at 150 to 180 days, it is possible to select breeding animals from the most productive litters.

Several of the breed associations have production registry programs. The production of the ancestors is recorded on the pedigree in the same way as production records of dairy cows are reported on the pedigrees of cows. The National Association of Swine Records has developed a production record plan based upon the number of pigs farrowed in the litter and the weight of the litter at 56 days of age. A litter qualifies for production registry when there are eight or more pigs farrowed and raised by a mature sow to a 56-day weight of at least 320 pounds. A first litter gilt must raise the same number of pigs to a 56-day weight of at least 275 pounds.

Sows qualify for production registry after producing two production registry litters. Boars must sire five qualified daughters, or fifteen daughters which have produced one production registry litter, to qualify as production registry sires.

FIGURE 37. *A Duroc Production Registry litter raised by Bill Stokes, Hutchins, Texas, in 1952. The eight pigs weighed 457 pounds at 56 days, averaging 57 pounds. (Courtesy United Duroc Record Association.)*



Litter testing of the home herd can help materially in the improvement of the productiveness of the herd. It is a good practice to purchase breeding stock from a breeder who has maintained production records. It is possible to breed hogs that are productive and have excellent type and conformation at the same time.

Health. Breeding animals which are large and heavy for their age usually are in good health, but the best policy is to buy only animals which have been vaccinated for cholera and tested for brucellosis. In some areas it may be desirable to buy animals vaccinated for erysipelas. The herd from which the animals come should be inspected, and breeding and feeding stock should be purchased only from disease-free herds.

Atropic rhinitis and vesicular exanthema, as well as necrotic enteritis and various forms of scours, have caused losses of hogs in some areas during recent years. Careful hog producers inspect the herds and the farms on which they are raised before buying breeding stock. Many breeders will not buy breeding or feeding animals which have been marketed through public sales barns or stockyards. The policy of buying only disease-free stock and keeping them away from other hogs for two or three weeks is a sound one.

Disposition. The disposition of a sow may materially affect the number of pigs she will save at farrowing time. A sow that is nervous and easily disturbed is more likely to lie or step on pigs than is a sow with a quiet disposition. In selecting breeding animals it is a good idea to choose those with friendly dispositions. Quiet animals and those that like to be scratched usually have good dispositions and are good gainers. A good brood sow should permit you to enter the pen at any time, even during farrowing. Many pigs are lost at farrowing time because the sow is too nervous to permit the caretaker to enter the pen and assist.

The disposition of a boar is equally important because the boar will be the sire of the next year's sow herd. An extremely nervous boar is undesirable, as is an extremely quiet or inactive individual. A boar should be friendly in disposition, active, and good rustler. Inactive boars are usually slow breeders.

FEEDER PIGS

The number of farmers who buy feeder pigs has increased in recent years. Cattle feeders have always purchased large numbers of feeder pigs to follow cattle in fattening lots because it is easier

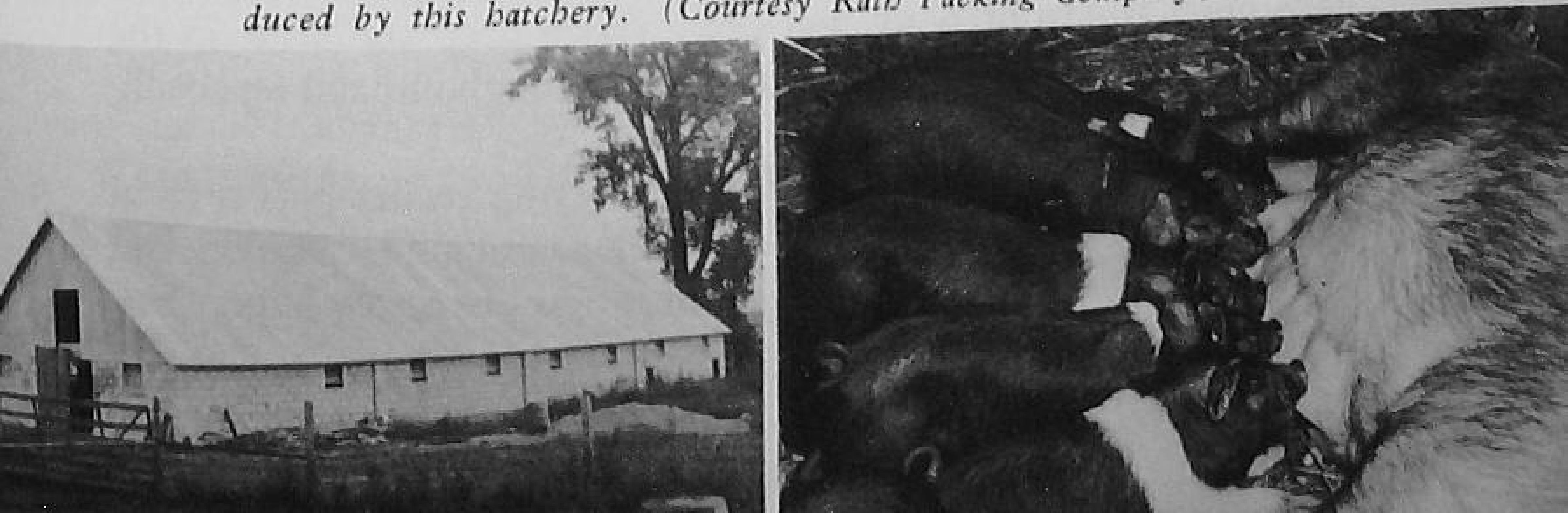
for them to buy the pigs as they are needed than it is to maintain a breeding herd. But we now have a new group of buyers. Many farmers who have been unsuccessful in raising pigs because of disease losses are now buying pigs in fairly large numbers.

It has been estimated that any farmer who cannot raise an average of 6½ pigs per litter on his farm will find it to his advantage to buy pigs rather than to try to produce them himself. The average number of pigs weaned per litter in this country is rarely above 6½ to 6¾ pigs. There is considerable interest among commercial pork producers in the purchase of feeder pigs.

Pig Hatcheries. Numerous pig hatcheries are now producing pigs to be sold at weaning age to farmers and feeders. The greater share of these hatcheries is in Wisconsin, Minnesota, Illinois, Iowa, and in Canada. The climate in Canada and in the northern sections of Minnesota and Wisconsin is not favorable for the production of grain crops in quantities sufficient to feed out large numbers of hogs. Swine diseases are not serious in these areas, so many farmers produce pigs to be sold as feeder pigs. It was estimated that more than 500,000 pigs were sold as feeders in Wisconsin in 1951. The production and marketing of feeder pigs has been expanded since that time.

An example of one of the pig hatcheries in Iowa is shown in Figure 38. The building is larger but similar in construction to the average Corn Belt hog house. The interior has farrowing pens approximately 8 feet square. The sow and litter remain in the pen until the pigs are weaned. At the time that these pictures were taken Duroc sows were being used and were mated to Hampshire boars. Most pig hatcheries are using crossbreeding or a rotation system of breeding. One hatchery in Wisconsin used inbred Poland China, purebred Hampshire, purebred Spotted Poland China, and inbred Landrace-Poland China bloodlines in their breeding program.

FIGURE 38. *(left) An Iowa pig hatchery. (right) A typical crossbred litter produced by this hatchery. (Courtesy Rath Packing Company.)*



Most successful producers of weanling and feeder pigs now market the pigs when they weigh from about 40 to 50 pounds. The pigs are healthy and have smooth hair coats. They have been castrated and vaccinated for cholera, and in some cases have been deloused and wormed.

Selection of Feeder Pigs. Regardless of the source, extreme care must be taken in the selection and purchase of feeder pigs. The reputation of the breeder, the breeding stock used in producing the pigs, the type and conformation of the pigs, the health of the animals, and the purchase price must be carefully considered.

Reputation of the producer. In buying an automobile, a tractor, or a life insurance policy, we check upon the reputation of the manufacturer or the company. The reputation of the "Trade Name" of the company is important to us. We should practice the same method in buying feeder pigs. Learn from the neighbors, the vocational agricultural instructor, or the agricultural extension director the experiences of others who have purchased pigs from the various sources. If possible, visit the producer and evaluate the man and his production program.

Breeding stock. Quite often we buy feeder pigs because the producer of the pigs was able to use better breeding stock than we could provide for a small breeding operation on our own farms. We are anxious to get as much hybrid vigor as possible, so it is important that we study carefully the quality and conformation of the breeding stock and the methods used in breeding. Certain breeds and lines cross better than do others. Select, whenever possible, those pigs which were produced by the best breeding methods. Feeder pigs produced as a result of a rotation system of breeding involving Hampshire or Hamprace, Poland China, and Duroc bloodlines should possess hybrid vigor and excellent carcass quality. There are many other excellent crossing programs.

Type and conformation. We desire in the feeder pig the type and conformation necessary to produce a high-quality market hog. The pigs must be growthy and large for their age. They must have good length of body and carry down deep and wide in the ham. We like them to have good width throughout, and especially over the loin and in the chest.

Feet and legs are less important in selecting feeder pigs than in selecting breeding animals. We prefer sound underpinning and quality of bone. The muscling or meatiness of the pig is very im-

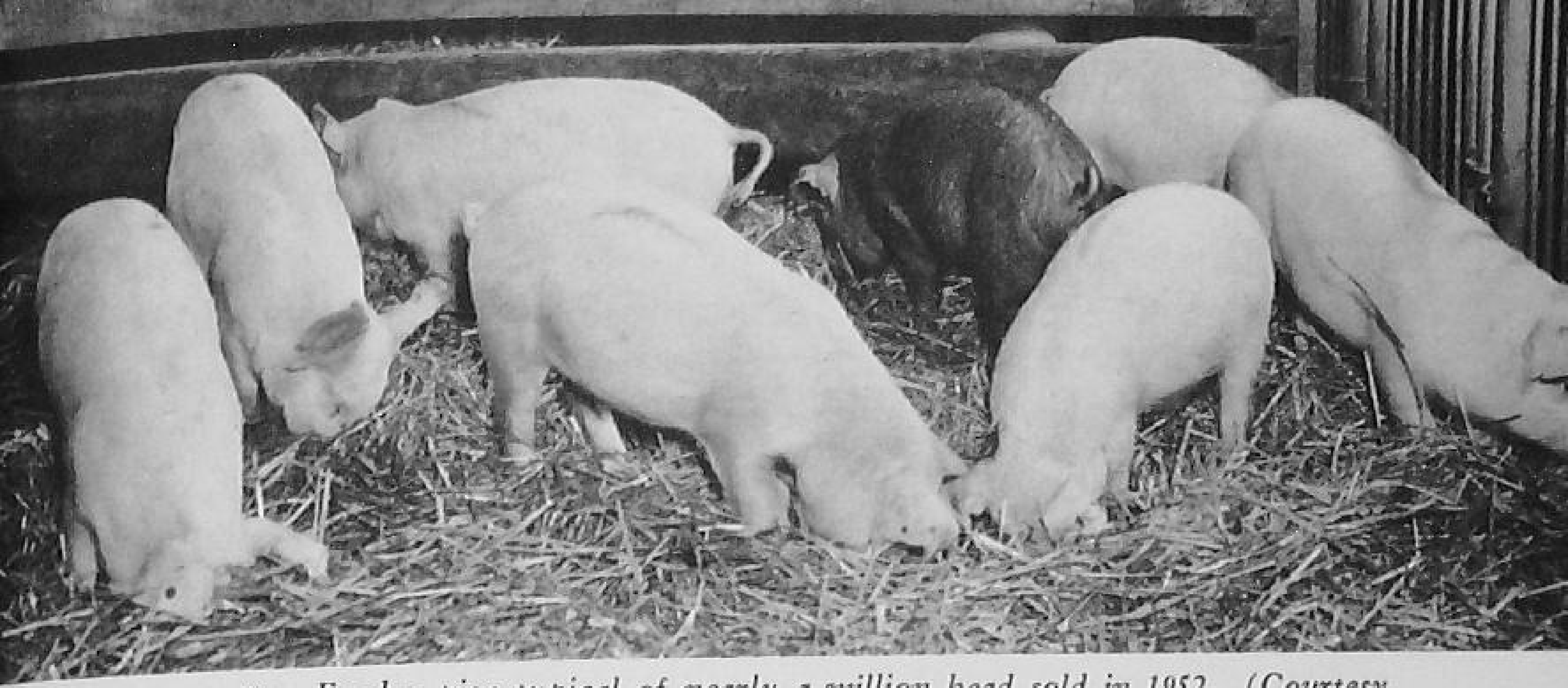


FIGURE 39. *Feeder pigs typical of nearly a million head sold in 1952.* (Courtesy Wallaces' Farmer and Iowa Homestead.)

portant; a pig which is flabby will not usually grow and fatten out well. Trimness of head, jowl, and shoulder are necessary if we are to produce carcasses of high quality.

Health. You cannot afford to take chances in buying feeder pigs. Make certain the pigs are from a disease-free herd and have not had an opportunity to become infected while being transported or marketed. Purchase only pigs which have been vaccinated for cholera, and also for erysipelas if the disease is prevalent in the area. Avoid pigs with heavy skin or rough hair coats. The hair coat on a pig is a good indication of the health of the animal.

Price. How much is a feeder pig worth? There is no one answer to this question. The price varies with the needs of the prospective buyer, the availability of the pigs, the price of farm grains, the market outlook for pork products, and the crop outlook. In 1953, 40-pound feeder pigs which were vaccinated, wormed, and castrated were selling for $13.50 per head delivered to the farm. The top price on No. 1 market hogs at that time was $19.50 per cwt. Efficient producers could then raise their own feeder pigs for less money. The inefficient producers, and those without breeding stock and facilities, purchased the pigs at $13.50 per head and felt that they had made a good buy.

SUMMARY

Good breeding stock is essential for a profitable swine enterprise. Care must be taken in the selection of individuals and of breeds so that they will mate well in the breeding program to be followed. Most commercial hogs are crossbreds sired by purebred, inbred, or "hybrid" boars. For maximum hybrid vigor, a rotation system

should be followed which involves the use of two to four carefully selected breeds or lines.

There is no one best breed of hogs. The differences among the animals within a breed may be greater than the differences between the breeds. A man can be successful raising any one of the breeds providing he selects the right kind of breeding stock and uses good production and marketing practices.

In the selection of breeding stock, emphasis must be placed upon the productiveness of the animals in terms of prolificacy, rate and economy of gain, and the quality of carcasses produced. We need to produce a better muscled carcass, one that is low in backfat and lard and high in the lean cuts. A decrease in backfat and an increase in carcass length increases the proportion of lean cuts to fat and lard.

We need more length in many of our common breeds of hogs. At the same time we need to develop hogs with trimmer jowls and heads. Some of the new breeds have been developed to bring about these needed changes; the established breeds are making progress in this direction.

The pig hatchery business is bringing about a change in the breeding and feeding practices on many farms. To what extent it will affect hog production practices in the country is still uncertain. Farmers must be very careful in buying feeder pigs in order to obtain healthy pigs of good breeding at a reasonable price.

QUESTIONS

1. How do you account for the popularity of the various breeds of hogs grown in your community?
2. Which should you produce on your farm, the bacon- or the meat-type hog? Why?
3. What use can be made of the new breeds of hogs in your community?
4. What are the advantages of crossbreeding over upgrading and the breeding of purebreds?
5. What factors should you consider in selecting individual boars and gilts for your home herd?
6. What kind of a production testing program should you use on your farm to improve the productiveness of your herd?
7. Describe the type and conformation of the kind of barrow which will top the market.
8. Describe the type and conformation of the breeding stock you will use in order to produce the desired kind of market hogs.

9. What future do you see for the pig hatchery business?
10. Can you buy feeder pigs for less than the cost of producing them on your home farm?
11. What precautions must you take in buying feeder pigs?

REFERENCES

Anderson, Arthur L., *Swine Management*, J. B. Lippincott Company, Philadelphia, 1950.

Ensminger, M. E., *Swine Husbandry*, The Interstate Printers and Publishers, Danville, Illinois, 1952.

McMillen, W. N., *Hog Profits for Farmers*, Windsor Press, New York, 1952.

Smith, William W., *Pork Production*, The Macmillan Company, New York, 1952.

Winters, L. M., *An Introduction to Breeding Farm Animals*, John Wiley & Sons, Inc., New York, 1942.

< 7 >

Feeding and Management of the Breeding Herd

The profit or loss from a swine-breeding herd is often determined by the number of pigs weaned and marketed per sow. An average of five or six pigs marketed per sow is usually necessary to come out even. For profitable hog production we need to increase the number of pigs farrowed, weaned, and marketed.

It has been estimated that out of one hundred pigs farrowed only sixty-five will live to be weaned, and only fifty-five will be marketed. Tests conducted at Iowa State College indicated that when eleven pigs were weaned per litter, the average cost of each eight-week-old pig was about \$10.45. When nine pigs were weaned the cost was \$12.01 per pig. Pigs from litters of seven weaned cost \$14.52, and pigs from litters of five cost \$17.92 at weaning time. These figures would indicate that unless we can save seven or more pigs per sow we should consider buying feeder pigs, or anticipate little profit from the enterprise.

The feeding and management of the herd at breeding time and

FIGURE 40. *A group of Hampshire sows and litters on pasture in Illinois. (Courtesy* American Hampshire Herdsman.)

FIGURE 41. *A group of thrifty, well-grown Duroc gilts on alfalfa pasture in Iowa. (Courtesy Gregor Vaske.)*

during the gestation period can greatly influence the number of pigs farrowed and weaned. Good production methods will result in the following:

1. More pigs being farrowed per sow
2. Larger and healthier pigs at birth
3. Fewer dead pigs, runts, and abnormal pigs per litter
4. Better production of milk by the sows
5. More and heavier pigs weaned per litter

Feeding and Care During the Breeding Season. A farmer may decide that the small litters produced are due to the lack of prolificacy in his breeding stock. Usually he is wrong in making this assumption. Small litters are very often a direct result of carelessness in the feeding and management of the herd at breeding time.

Age to breed. Gilts should be bred to farrow when they are eleven to thirteen months of age if they have been well grown out. The maturity of the gilt is more important than its age. Most gilts which have done well reach puberty and come in heat when they are five to six months of age. It is not a good policy to breed gilts during their first heat periods. Larger litters usually result from gilts bred during their third or fourth heat periods.

Gilts should be well grown out and weigh from 200 to 250 pounds at breeding time. Boars should be a little heavier if they

are to receive heavy service. Some breeders prefer to use mature animals, fall boars, or early spring boars in their breeding programs. The older boars are more dependable, especially in settling mature sows.

Heat period. The heat period, which usually lasts two or three days, is the time during which the sow will accept the boar. It is better to breed the sow during the second or third day of the heat period than during the first day. Sows that are in heat are usually restless and frequently mount other sows. The vulva is usually enlarged and enflamed. Sows that are not bred will usually come in heat at intervals of about three weeks.

Gestation period. The period of time between the breeding of the sow and the farrowing of the litter is known as the *gestation* or *pregnancy period*. The length of period varies somewhat with sows but is usually from about 112 to 115 days. Breeders quite often figure 114 days as the gestation period. Older sows usually have longer gestation periods than gilts.

Time to breed. Farmers plan their breeding operations to have the pigs farrow when the temperature, housing, pasture, and labor conditions are favorable. They also plan farrowings so that the pigs can be grown out and ready for a desirable market. A large percentage of the hog producers in the Corn Belt raise but one litter per sow per year. These men breed the sows so that they farrow in the spring. October, November, and December are the months during which most sows are bred.

TABLE 8

SWINE BREEDING AND FARROWING DATES

Date Bred	*Date Due to Farrow*	*Date Bred*	*Date Due to Farrow*
January 1	April 24	July 1	October 22
January 15	May 8	July 15	November 5
February 1	May 25	August 1	November 22
February 15	June 8	August 15	December 6
March 1	June 22	September 1	December 23
March 15	July 6	September 15	January 6
April 1	July 23	October 1	January 22
April 15	August 6	October 15	February 5
May 1	August 22	November 1	February 22
May 15	September 5	November 15	March 8
June 1	September 22	December 1	March 24
June 15	October 6	December 15	April 7

Farmers who produce two litters of pigs per sow, or who produce litters in both the spring and the fall, breed their sows to farrow in August and September as well as in February and March. Table 8 shows the dates of breeding swine and the corresponding farrowing dates, based upon a 114-day gestation period.

One- or two-litter system. Packers and marketing specialists have encouraged farmers to follow a two-litter system of breeding in order to make economical use of the capital invested in breeding stock and equipment and to distribute the marketing of hogs throughout the year. At one time a large percentage of the hogs produced in this country were farrowed in the spring and sold during the following fall and winter. The supply during the marketing period exceeded the packer demand, and low prices resulted. The tendency during the past several years has been to increase the number of fall litters and to decrease the number of spring litters. More producers are now raising two litters from each sow each year. As a result we have a more uniform price of hogs throughout the year.

There are now about as many fall pigs farrowed in Indiana and Ohio as there are spring pigs, whereas in Iowa the number of spring pigs farrowed is considerably larger than the number of fall pigs farrowed.

The advantages of the one- and two-litter systems are described by Indiana specialists as follows: [1]

Advantages of the One-Litter System

1. Had a 3 per cent lower cost of production
2. Fewer management headaches; easier to keep on schedule
3. Less total capital tied up in hog buildings and equipment
4. Corn storage requirements are fewer
5. Weather usually more favorable at farrowing time
6. Less labor and hard work required
7. Bulk of corn fed in season of low corn price
8. Pigs were big enough to hog down corn, glean corn fields, and to follow winter-fed cattle

Advantages of the Two-Litter System

1. Received 5 per cent higher selling prices
2. Can produce more pork on given acreage
3. Equipment and building were used more fully

[1] Lowell S. Hardin and others, *Hogs—One- and Two-Litter Systems Compared*, Indiana Agricultural Experiment Station Bulletin 565, Nov. 1951.

4. Equipment cost may be less per 100 lbs. of pork produced
5. Conducive to better selection of breeding stock
6. Labor load more evenly distributed
7. Income and market risk is spread over two major marketing seasons instead of one
8. Larger proportion of pork marketed as butcher hogs rather than as sows

The system which will be most profitable on your farm will depend upon the size of the hog enterprise and its relationship to the other enterprises on the farm. Cattle feeders like one-litter systems. Producers of butterfat like two-litter systems so that they will have pigs to consume skim milk during all months of the year. On most farms the advantages of the two-litter system outweigh the advantages of the one-litter system.

Flushing. The condition of the sow or gilt at breeding time affects the regularity of the heat period, the number of eggs or reproductive cells produced, and the conception or the settling of the sow at the first service. *Flushing* is the feeding of the sows to insure their good health and a gain of from 1 to 1½ pounds per day from about two weeks before breeding until after they are bred. Gilts or sows which are recovering from "flu" at the time of breeding seldom produce good litters. It is better to flush these sows and breed them for a later litter.

The ration to be fed during the flushing period will vary with the age and condition of the sow and with the feeds and pastures available. It is important that the ration be well balanced and fed in the proper amounts. Plenty of proteins, minerals, vitamins, and forages are desired. Gilts usually should receive 2½ to 3 pounds of feed daily per hundred pounds of live weight, whereas mature sows may need less than 2 pounds daily for each hundred pounds of live weight. Usually a ration consisting of ½ to ¾ of a pound of a balanced protein and mineral supplement, 1 pound of oats, and enough corn or other grains fed each day to produce daily gains of about 1½ pounds will meet the needs of a sow during the flushing period. Sows which are not on pasture should be self-fed alfalfa hay or should receive from 1 to 2 pounds of alfalfa meal daily. Sows and gilts should not become overfat.

Feeding and management of the boar. Normally, if the boar is in good, thrifty condition and is well managed, he will not affect unfavorably the size of the litters which he sires. If his vitality is

too low or if he is used very heavily, the sperms, or male reproductive cells, may be so weak that only a part of the eggs produced by the female will be fertilized, and small litters may result.

On some farms the boar is a neglected individual. He is purchased at breeding time and placed in a pen in the hog house. He may have been used previously by other farmers. He is in poor physical condition. Quite often he is fed too little protein, mineral supplement, and vitamins. Such a boar will be low in vitality and may prove to be a poor breeder.

The boar should receive about the same kind of a ration fed to the gilts during the flushing period. He should not be fattened but kept in good, thrifty condition. The following rations are suggested:

Ration 1
(Boar or sow on pasture)

	Pounds
Corn, ground barley, or grain sorghums	73
Ground oats or wheat	15
Meat scraps	5
Soybean meal	6
Mineral	.5
Salt	.5
	100

Ration 2
(Boar or sow in dry lot)

	Pounds
Corn, ground barley, or grain sorghums	60
Ground oats or wheat	15
Meat scraps	7
Soybean meal	7.5
Ground alfalfa	10
Salt	.5
	100

The boar should be given a lot of from about ¼ to ½ acre, which has been seeded to alfalfa, red clover, ladino clover, or some other forage crop. A movable house should be provided at one end, and he should be fed and watered at the other end of the lot. Exercise is important in caring for a boar.

Yearling and other mature boars can be mated to fifty or sixty gilts during a breeding season if properly managed. An eight-month-old boar should not usually be expected to service more than twenty to thirty sows unless he is very carefully managed.

Pen- versus lot-breeding. It is usually better to bring the boar to the sow or the sow to the boar at the time of service rather than to permit the boar to run with the sows. One good service is normally sufficient, and a record can be kept of the breeding date. A young boar turned in with a large number of sows may be punished and become shy. This is especially true if mature sows are involved.

A mature boar should not be mated to more than three sows

during one day, and a young boar should not serve more than two sows per day. Some farmers who practice pen-breeding bring a sow to the boar in the morning and another sow during the evening. Breeders of purebreds often space services six or eight hours apart and breed as many as four sows to an outstanding sire in one day. This plan cannot be followed throughout the entire breeding season.

Ranty and inactive boars. Some boars are very active during the breeding season and pace back and forth along fences or go through the fence. They may be difficult to manage, but are excellent breeders. Some breeders place a barrow or a bred gilt with the boar with excellent results. A better practice is to keep the boar in a lot at some distance from the sows.

Other boars are inactive—quite often because of improper feeding and management—and are slow breeders. It is a good idea to try out a boar a month or so before the breeding season begins to make certain the boar will serve and settle a sow. If he does not serve or does not settle the sow, the situation can be remedied before time to breed the main herd.

A boar may be inactive because he has become too fat or has not had sufficient exercise. Many so-called *nonbreeders* are boars of this type. Be certain your boar is in good breeding condition. It is a good policy to turn two boars together in case one is inactive. The boar should be familiar with his surroundings because quite often a boar will not service a sow in new quarters. Some boars will not serve a sow when humans or other hogs are around. Pen-breeding is preferable from this standpoint.

Some boars breed only at night or early in the morning. It is a good idea to try out the boar and bring gilts to him at the time of day when he is most active. It is not a good idea to start a young boar by mating him to mature sows. It is much better to mate him to gilts of his own age and size.

A breeding crate also may be helpful in getting a boar to serve a sow. This is especially true in mating mature boars with young gilts. It is possible to make a temporary crate of straw bales and panel gates, or a commercially made crate may be used.

A number of products are sold as remedies for the inactivity of boars, but in most cases they are not effective. A veterinarian should be called in if it is necessary to use drugs or hormones.

Breeding records. A record of the breeding dates for the sows

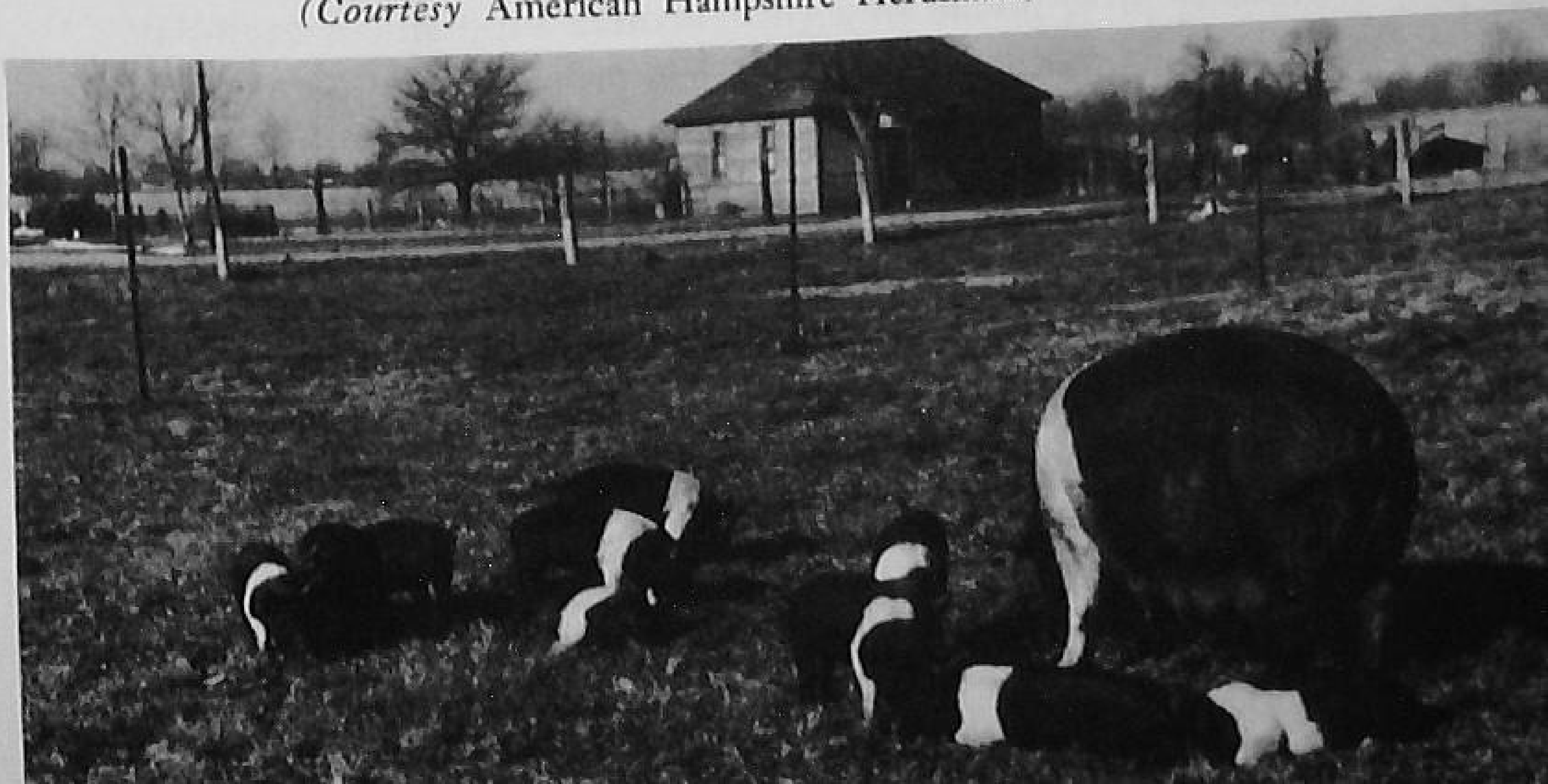
in the herd is very helpful in checking upon the ability of the boar to settle sows and in selecting sows to be kept in the herd. It is also helpful in selling bred sows. The buyer will need to know when to expect the sows to farrow.

The breeding record is helpful at farrowing time in deciding when to pen up the sows. It is a good practice to mark the gilts as they are bred by use of ear tags or by clipping hair on the hip or back, and to record the mark and the date of breeding. Many farmers follow this practice and breed more sows than they will need. After the sows have passed the next heat period and are settled, the farmer selects those that he wishes to keep in the herd and markets the others.

Feeding and Care During Gestation. The vigor of the pigs and the number produced in the litter at farrowing time are determined by the number of eggs fertilized by the boar at the time of breeding and by the methods used in feeding and managing the sows during pregnancy. Not all eggs fertilized at breeding time produce live healthy pigs at farrowing time. Some of the fertilized eggs produce embryo pigs which die early in the pregnancy period and are absorbed. Others die later, and are farrowed as dead pigs. Those that live but are weak are sometimes called "squealers."

The ration fed the sow has much to do with the type of litter which she will farrow. The methods used in feeding, exercising, and housing the sow also influence the number of healthy pigs which she will farrow. The kind of litter that we should strive to produce is shown in Figure 42. Note both the number and the health of these pigs.

FIGURE 42. *A 9-Star Hampshire Production Registry sow and her 9th P.R. litter. (Courtesy* American Hampshire Herdsman.)



Rations for bred sows and gilts. Bred sows use feed to maintain their bodies and also to produce litters of pigs. Young gilts also need feed to grow and become mature sows. If the rations are inadequate, the sows will be ineffective in maintaining themselves and in producing strong litters. Weak pigs may result. Young sows may remain small or stunted in growth and be poor milkers. The feeding of a balanced ration in adequate amounts during pregnancy is a must in profitable pork production.

The age and condition of the sow determine the amount and kind of a ration which she should receive. Thin sows require more feed than do sows in good flesh. Large sows need more feed than do small sows, and young sows must have more feed per hundred pounds of live weight than must mature sows. The stage of pregnancy also must be considered. Generally speaking, a thin mature sow will require from 1 to 1¼ pounds of feed daily, and a young gilt will need from 1½ to 2 pounds daily, for each hundred pounds of live weight. They should also have access to good pasture or high-quality alfalfa or clover hay. The amount of feed is usually increased gradually as the pregnancy period progresses.

The ration best suited to your farm must be based upon feeds available and the prices of feeds in your community. The following rations, however, may be helpful in planning a suitable ration.

Grain sorghum may be substituted for corn, oats, or barley in the ration but should be fed ground. Rye may be fed in small quantities, but it cuts down the palatability of the ration.

The feeding of a pound or two of whole dry oats per sow, hand-fed, with enough corn to keep the sow in good gaining condition may form the basis for a satisfactory ration. The sows should receive in addition a good mineral mixture, alfalfa or clover hay and from ½ to ¾ pound of a good protein supplement each day.

Sows on pasture will quire less grain and supplement.

The addition of antibiotics to the ration of healthy sows during gestation has not provided enough extra pounds of pigs at weaning time to pay the extra cost of the antibiotics. Sows which are unthrifty, however, may respond satisfactorily to the feeding of antibiotics.

Methods of feeding. Sows and gilts may be hand-fed once or twice daily during gestation, or they may be self-fed. Plenty of bulky feeds, such as ground alfalfa or clover hay, should be included in the self-fed ration to keep the sows from getting too fat.

Ration No. 1 for Bred Sows on Pasture
(Wisconsin Circular 355)

	Pounds
Ground corn	60
Ground oats, wheat, rye, or barley	34
Tankage or meat scraps	6
	100

Ration No. 2 for Bred Sows in Dry Lot
(Wisconsin Circular 355)

	Pounds
Ground corn	40
Ground oats, wheat, rye, or barley	33
Tankage or meat scraps	7
Ground alfalfa hay	20
	100

Ration No. 3 for Bred Sows in Dry Lot
(*Balance Swine Rations*, Iowa State College)

	Pounds
Ground corn	600
Ground oats	600
Alfalfa meal	600
Sow and pig supplement	200
	2000

SOW AND PIG SUPPLEMENT:

60% Tankage	300 lbs.
44% Soybean oil meal	950 lbs.
41% Cottonseed meal	100 lbs.
34% Linseed meal	100 lbs.
17% Dehydrated alfalfa meal	300 lbs.
Ground limestone	60 lbs.
Steamed bonemeal	110 lbs.
Salt	40 lbs.
Trace mineral mix	15 lbs.
Vitamin D_2	4 million units
Vitamin B_{12}	60 milligrams
Riboflavin	12 grams
Niacin	70 grams
Calcium pantothenate	12 grams
Choline chloride	450 grams
Antibiotics	60 grams

Ration No. 4 for Bred Sows on Pasture
(Cornell Extension Bulletin 727)

	Pounds
Ground corn	73
Meat scraps	2
Soybean oilmeal	3
Wheat middlings	20
Ground limestone	1.5
Salt or iodized salt	.5
	100

The ground alfalfa or clover hay should make up approximately one-third of the ration. A self-fed ration of 650 pounds of ground corn, 650 pounds of ground oats, 650 pounds of ground alfalfa, and 200 pounds of supplement is quite satisfactory.

Many farmers like to hand-feed brood sows so that they can watch them more closely than when they are self-fed. The ration may be mixed with water and fed as a heavy slop. Sows will usually consume more feed and more water when slop-fed. The additional labor, however, is an important factor when many sows are involved.

Plenty of water should be fed to sows during pregnancy either in the form of slop feeds, in troughs twice daily, or provided in automatic waterers. Water is especially important during the summer when the temperature is high. Fresh water should be available to the sows at all times.

Exercise. During the early stages of gestation it is desirable to have the sows forage in the cornstalk fields or in the pasture. Brood sows need exercise, and if they do not rustle out into the fields themselves, they should be fed at a distance of from 10 to 15 rods from their housing quarters. It is not a good policy to feed brood sows in the hog house or just outside their housing quarters. Inactive, fat sows rarely produce and raise good litters. The gilts shown in Figure 43 are in excellent condition and should produce healthy litters.

Housing quarters. During the summer months pregnant sows need only a wooded area, open sheds, or shades to protect them from the sun and rain. Portable houses with open doors or straw sheds are satisfactory during the winter months in many areas. In the northern Corn Belt warmer houses may be necessary. Several

FIGURE 43. *These gilts are in excellent condition as a result of proper feeding and exercise. (Courtesy Gregor Vaske.)*

sows may sleep in one house, but they should not be crowded; from 15 to 20 square feet of floor space should be provided for each sow. The hog house does not need to be warm if it is dry and free from drafts and dust.

Sows should not be kept in the same lots or buildings with other types of livestock. Sows heavy with pig may be injured by cattle or horses, or may injure themselves by crowding or by going up steep inclines, under creeps, or in low doors. Sows should not be in the cattle feed lots.

Pasture. A brood sow during gestation can make very effective use of good pasture. Sows that have access to alfalfa, clover, rape, or other good pasture need little or no grain during the first half of the pregnancy period. They will need only about one-half as much grain during the latter part of the pregnancy period as they would have needed had they been in dry lot.

Ladino clover and alfalfa have proved to be our best pastures for brood sows in most of the hog production areas.

SUMMARY

Large litters of healthy pigs are necessary for profitable hog production. The cost of a pig from a litter of nine is about 40 per cent less than the cost of a pig from a litter of five. With good practices it is possible to produce litters averaging eight to ten pigs weaned per sow.

Mature sows produce more and larger pigs than do gilts but require more feed and greater investment. Mature boars are more dependable breeders but are more difficult to manage. Gilts and boars should weigh from 200 to 250 pounds before being mated.

Sows and gilts usually come in heat every three weeks and remain in heat for about three days. The gestation period is approximately 114 days. It pays to raise two litters from each sow each year.

The boar and gilt should be in good health at breeding time. Flushing the sows results in larger litters and a higher percentage of the sows settling at first service. It usually pays to pen-breed and to keep an accurate record of breeding dates.

The sows on dry lot during gestation should receive a bulky, well-balanced ration containing approximately 600 pounds of ground oats, 600 pounds of ground corn, 600 pounds of ground alfalfa, and 200 pounds of a good protein and mineral supplement.

The feeding of antibiotics to healthy brood sows has not proven profitable.

Brood sows need plenty of fresh water and exercise. They should be forced to walk ten rods or more for feed during good weather. Sows make very good use of pasture. Ladino clover, red clover, and alfalfa are excellent pastures for brood sows.

QUESTIONS

1. How much more profit could you make on your farm if you could save an extra pig per litter?
2. Should you keep mature sows and boars or use young untried breeding animals? Why?
3. Does it pay to pen-breed and keep breeding records? Why?
4. When should sows be bred to farrow February and March litters?
5. How often will gilts come in heat?
6. Is it better to breed sows the first, second, or third day of the heat period?
7. What care and management should be given the boar during the breeding season?
8. Plan a good ration for flushing a group of 225-pound gilts.
9. Outline a good ration and feeding program for the sows during pregnancy, assuming that they are on alfalfa pasture.
10. What changes would you make in the ration if the sows are in dry lot? Why?
11. Should sows be hand-fed or self-fed during gestation? Why?
12. Does it pay to feed antibiotics to brood sows during gestation?

REFERENCES

Brinegar, M. J., and Warner, D. R., *Nutrients, Feeds and Example Rations for Swine*, Circular 253, University of Nebraska, Lincoln, Nebraska, 1951.

Ensminger, M. E., *Swine Husbandry*, The Interstate Printers and Publishers, Danville, Illinois, 1952.

McMillen, W. N., *Hog Profits for Farmers*, The Windsor Press, New York, 1952.

< 8 >

Feeding and Management of Market Hogs

Critical periods in the production of market hogs occur at farrowing time, during the suckling period, at weaning time, and during the period from weaning until the pigs have been marketed. The successful producer plans carefully the practices which will be followed during each of these periods. If he fails to care for his hogs properly during any one of the periods, serious losses may take place. He may have fewer pigs per sow at weaning or at market time; the pigs may be unthrifty and require a long period of time and a large quantity of feed to get them ready for market; or the quality of the hogs produced may be so poor that they cannot be sold as No. 1 hogs. The practices discussed in this chapter will help prevent these losses.

CARE AND MANAGEMENT AT FARROWING TIME

Some farmers have been successful in producing only one litter of pigs per sow per year by having the sows farrow in late May or June in timber areas or on legume pasture with temporary shelters or houses. They give the sows little or no attention at farrowing time, but plan on saving fewer pigs per litter, and keep a few more sows than they would keep if they were to give them more attention. Sows need less attention during warm weather than during the winter or early spring. Whether this practice is economically sound depends upon a number of factors; the price of hogs, the capital and facilities available, the labor supply, and the feed situation. Many farmers now plan on two litters per year, which necessitates having sows farrow during the cold months of January, February, and March, and again during the hot months of July, August, and September. With the latter sys-

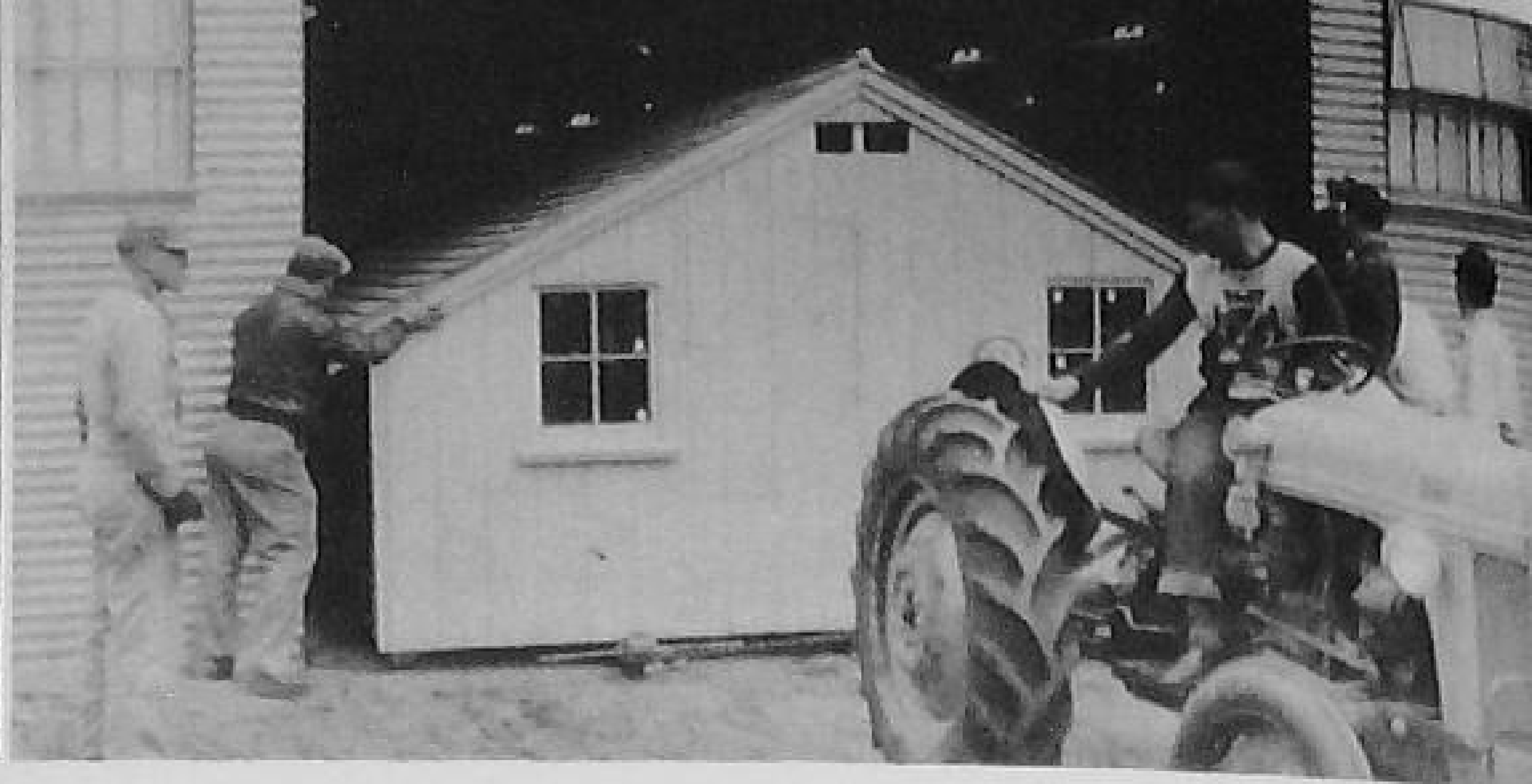


FIGURE 44. *(left) A four-pen movable hog house. (Courtesy Iowa State College.)*
FIGURE 45. *(right) A six-pen movable hog house made by a vocational agriculture student in the school shop at Jefferson, Iowa. (Courtesy Dirk Miller.)*

tem, special care of the sows and litters at farrowing time is necessary.

Housing. The portable hog houses or the pens in the permanent, central-type house should be cleaned and ready for use several days before the sows are due to farrow. Either type of house may be used with excellent results. The sow should be penned up a few days before farrowing so that she will be familiar with the surroundings and less likely to be nervous. The size of pen needed will vary with the age and size of the sow, and whether or not guard rails, pig brooders, or farrowing stalls are used. Pens 7 or 8 feet wide and from 8 to 10 feet long are preferred. In central-type houses the short side of the pen should be next to the wall or alley.

The house should be clean, dry, relatively warm, and well ventilated. The floors of movable houses should not be drafty due to cracks. It is sometimes a good policy to bank the sides and ends of movable houses with baled straw or with earth.

Some farmers raise the front side of the movable hog house from about 6 to 8 inches so that the sow will lie in the pen with her back toward the door. Fewer pigs are lain upon by use of this method. Some breeders have tilted floors in permanent hog houses. A floor slope of one inch to the foot is recommended.

Most movable houses have openings at the ends for ventilation. Windows in movable houses are not necessary from the standpoint of providing light, and are not satisfactory as means of ventilation. Numerous plans are available for movable hog houses. Those pictured in this chapter have been popular among hog breeders in the Corn Belt.

Whether a large central-type house for farrowing purposes should be built is questionable on some farms. The movable houses may be pulled up to the farmstead where electricity is avail-

FIGURE 46. *A central-type hog house which may be converted to a cattle barn. It has a 16-foot alley with 8-foot pens on both sides. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

able for use at farrowing time and then moved to the pasture to house the pigs during the summer. The investment in housing is much less when movable houses are used, and desirable housing is available during the summer months. Some producers use both permanent and movable houses.

Sanitation. Losses due to swine diseases and worms can be avoided in part by properly cleaning the farrowing pen before it is used. All dust, dirt and litter should be removed, and the floors and walls from 1½ to 2 feet from the floor should be scrubbed with boiling lye water. One pound of lye should be added to each 20 gallons of water. After the pen has been cleaned, it should be sprayed with a good disinfectant. Commercial disinfectants or

FIGURE 47. *The cleaned hog house is sprayed with cresol solution or disinfectant. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

a mixture of one pint of cresol solution to about 4 gallons of water may be used. The lye water loosens the dirt and kills the worm eggs while the disinfectant kills the germs of diseases. Equipment used in the pen should also be cleaned and sprayed.

The sides, underline, feet, and legs of the sow should be brushed and washed with soap and warm water before she is placed in the farrowing pen. Any dirt left on the sow may contain worm eggs which, if eaten by the pigs, could produce worm infection and runty pigs. In moving the sows or the pigs from one lot to another, it is best to haul them so that worm eggs or disease germs will not be picked up enroute.

Bedding. Coarse ground corncobs, wood shavings, fine straw, or sawdust may be used for bedding. Too much bedding or coarse hay and straw bedding may result in the loss of pigs. A deep depression in a heavily bedded pen will cause the pigs to lie too closely to the sow and will hinder them in getting away from the sow when she moves. A bushel basket or two of bedding in a pen is much better than a four-inch layer covering the entire pen. The bedding should be kept clean, dry, and well distributed. Removing the sow from the pen each morning and evening, for brief exercise, helps to keep the pen clean and dry.

FIGURE 48. *A sow is washed before being placed in the farrowing pen. (Hufnagle photo. Reprinted from* Successful Farming.)

FIGURE 49. *Guard rails protect pigs from being lain on. (Courtesy Rath Packing Company.)*

Guard rails. A number of devices have been developed to keep sows from lying on the pigs. A simple device is the guard rail which is placed on the back three sides of the pen from about 8 to 10 inches from the wall and from 8 to 10 inches from the floor. These may be made of metal pipe, native poles, or 2 x 4's. In any case, they should be installed several days before the sow is due to farrow so that she will be used to them. They permit the pigs to get back of the sow without being crushed between the sow and the wall. Guard rails have saved many pigs.

Heat lamps or brooders. The temperature in the farrowing house should range from about 50 to 60 degrees. When the temperature drops below 50 degrees, the little pigs chill and may take cold. The use of heat lamps or pig brooders is recommended for the first week or so after farrowing when the weather conditions are unfavorable. The heat lamp or brooder not only provides heat but also attracts the pigs away from the sow where they will be less likely to be stepped or lain upon.

The infra-red heat lamp type of brooder usually consists of a drop cord with a mechanical support, a socket, a heat bulb, and a protective reflector with screen over the end of the reflector. The bulb should be a 250-watt lamp. The hard pyrex heat-resisting bulb is preferred. In using heat lamps, care should be taken to avoid fire. Many hog houses burn each year due to carelessness in the use of heat lamps. The cord should be heavy rubber

covered and have a lock-type connector. The socket should be porcelain and keyless, and the lamp should be supported by a chain, wire, or bracket. The electric cord should never be used to support the heating unit.

The unit should be placed about 30 inches above the top surface of the bedding, and care should be taken that water cannot drip down on the heat lamp. To prevent the sow from getting into contact with the brooder, a barrier made of 2 x 4's should be built in the corner of the pen with room enough only for the pigs to get under the lamp for heat. The barrier should be pen height or 36 inches.

The hover-type brooder has had general use for several years and is an effective means of providing heat and protection. The brooder shown in Figure 50 provides a flat shelter with a heat lamp assembly placed in the middle. The brooder is usually built in the corner of the pen so that only the little pigs can crawl underneath.

The top of the shelter should be 12 inches from the litter. It is solid with the exception of a 12- to 14-inch hole in the middle where the reflector and bulb are placed. Usually a 75- to 100-watt bulb is adequate. A bulb larger than 150 watts should never be used. One-fourth-inch hail screen should be placed over the opening in the top of the shelter to prevent injury to the bulb and the pigs. As was recommended in using heat lamps, a barrier should be constructed to prevent the sow from coming in contact with the bulb assembly.

FIGURE 50. *A hover-type pig brooder. A barrier must be provided to keep the sow away from the brooder. (Courtesy Geo. A. Hormel & Co.)*

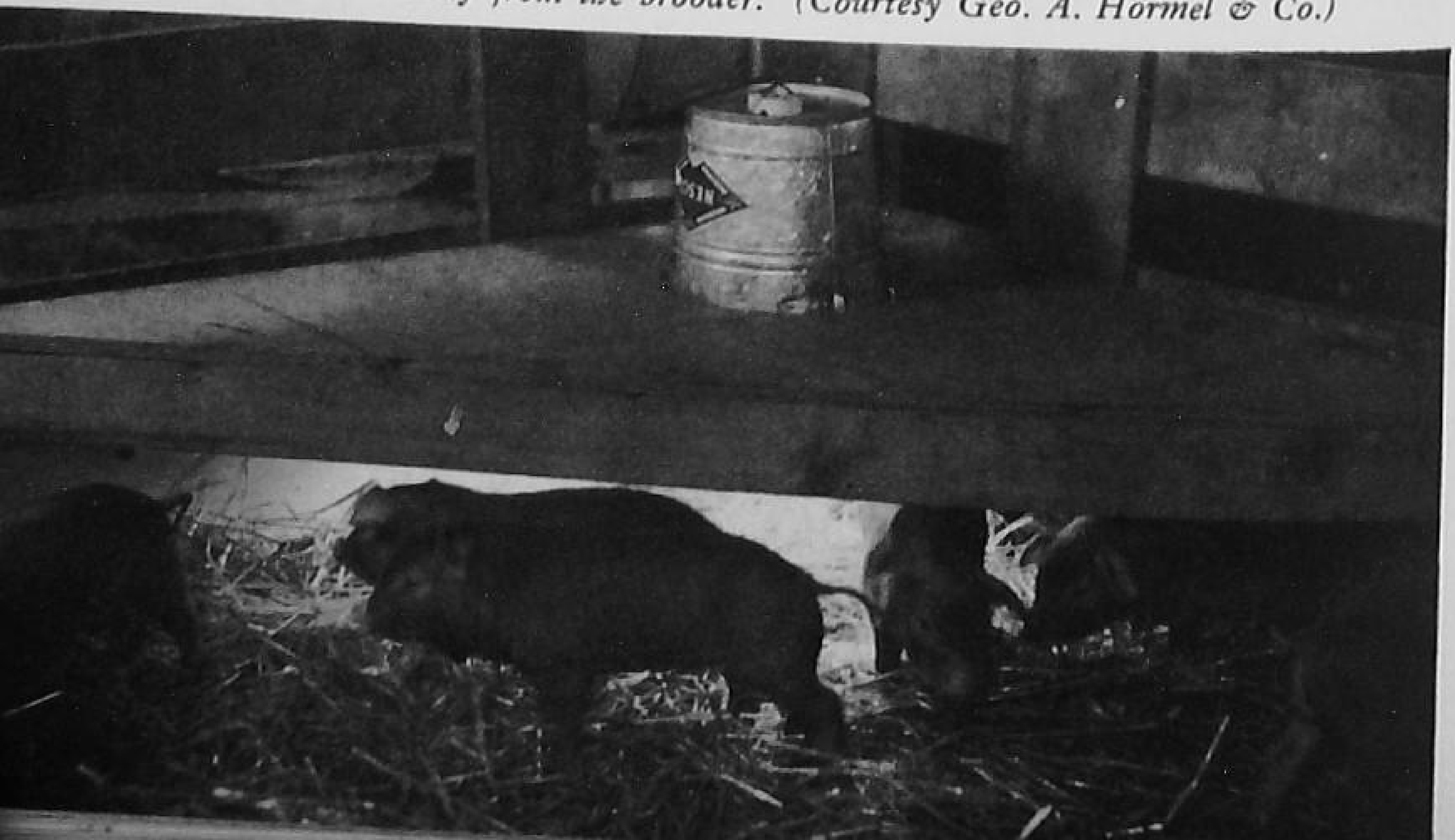


FIGURE 51. *A farrowing stall in use. Note that pigs can be on either side of the sow. (Courtesy Rath Packing Company.)*

In wiring a building for pig brooders, provide a permanent and separate circuit with a maximum of 1500 watts on each circuit protected by a 15-ampere fuse. The wire should be No. 12 size or heavier. The extension cords to the brooders should not be longer than 6 feet, and each pen should have a separate outlet. The pig brooder, like the guard rails, should be installed several days before time for the sows to farrow.

Farrowing stalls. The farrowing stall in Figure 51 shows the use of both guard rails and heat lamps, which is the most effective means of providing heat and protection for the pigs. One large producer who used farrowing stalls saved all but two pigs farrowed by a herd of twenty-two brood sows. It is estimated that farmers can save at least one more pig per litter by using these stalls.

The sow is confined in the stall, which is 24 inches wide, except when she is let out for feed, water, and exercise. The little pigs can run around the sow and under heat lamps on either side. Each heat lamp may be used by two litters at the same time, since a divider is provided to keep the litters separated.

The stall should be at least 6 feet long, but a length of 8 feet is preferred. A 2 x 4 across the back of the stall may be used to regulate length. The partition panels should be from 10 to 12 inches above the floor, depending upon the size of the sow. The same precautions should be taken in the use of heat lamps as were discussed previously in this chapter.

Sows may be left in the farrowing stall for just a few days or for several weeks. By moving the sows to regular pens after two or three days it is possible to use the same stall for several litters. The sow should be removed from the stall each morning and evening for exercise, feed, and water.

Feeding and Management. *Rations at farrowing time.* The sow should be fed a bulky, laxative ration in moderate amounts just previous to farrowing. She should receive all the water that she can drink, but cold water should be avoided. It is usually best to reduce the ration just before farrowing and to give her no feed for twelve hours after farrowing, unless she is nervous and appears hungry.

The following rations are recommended for sows at farrowing time:

Ration No. 1

	Per Cent
Ground yellow corn	30
Ground oats	30
Wheat bran	25
Soybean oilmeal	5
Alfalfa meal	5
Meat scraps	5
	100

Ration No. 2

	Pounds
Ground yellow corn	600
Ground oats	600
Alfalfa meal	600
Sow and pig supplement *	200
	2000

* Supplement described in Ration No. 3 for sows during gestation.

The sow may be fed the same ration after farrowing as before. It is usually best to feed about a half ration the first day and to increase the ration gradually until she is on full feed. Heavy milking sows should be hand-fed for the first week after farrowing. Other sows may be self-fed.

Assistance at farrowing time. Although most sows do not need assistance at farrowing time, it is a good policy to be on hand. Sows become nervous as they approach farrowing time and may pace the pen and scrape up bedding materials. Most sows farrow within 24 hours after milk develops in the nipples, but some sows will have milk in the nipples for two days or longer before farrowing.

If the pen is cold at farrowing time you may need to dry the pigs and place them under the brooder or heat lamp as they are farrowed. If the pen is not equipped with a brooder or heat lamp, the pigs may be placed in a box or basket and taken to the house, or a jug of warm water or heated bricks may be placed in the middle of the basket. The pigs should be returned to the sow to suckle as soon as possible. Pigs normally will suckle each two or three hours. If pigs are removed from the sow, they should be returned each two or three hours for nourishment. Some pigs may not show interest in nursing even though they are a day or two old. These pigs may respond to a hand-fed solution of half sirup and half water.

A good hogman has worked with his sows so that they are not nervous when he is present at farrowing time. If they are nervous, it is best to leave them alone or to work very quietly.

Generally speaking, when sows have difficulty farrowing, it is best to have a veterinarian render assistance. Many instruments are on the market for use in helping sows at farrowing time, but they must be used with caution, or serious injury to the sow may result.

A man with a small hand may straighten out a pig which a sow has been unable to deliver; however, under no conditions should one attempt to do this without the use of a rubber glove, which has been coated with vaseline. Brucellosis in hogs is readily transferable to man, and undulant fever may result.

Navel cord. Sometimes the navel cord is long, and it is impossible for the pig to move about freely. The cord should be cut, and the navel daubed with a tincture of iodine solution. The latter should be used on all pigs regardless of the length of the cord.

Needle teeth. The clipping of needle teeth is a controversial issue. Some hogmen do not clip the teeth because they believe that the mouth and gums may be injured, allowing infectious organisms to enter the body. The practice, if done properly, will not cause disease infections. It may even prevent them, because, when fighting, pigs will not be able to inflict wounds about the face that would permit necrotic and rhinitis organisms to enter the body.

There are four of these tusk-like teeth on each jaw. Clipping should be done with a pair of cutters in such a way that there is a clean, smooth break with no injury to the gums and no jagged

FIGURE 52. *Clipping points of the upper and lower incision teeth of a pig. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

edges. Many hog breeders have developed skill in clipping needle teeth and make it a regular practice.

Ear-notching. The notching of the pigs' ears at farrowing time is a universal practice among breeders of purebred hogs and among many commercial producers. It is the most practical method of identifying the pigs of a litter so that the productiveness of a sow can be determined and considered in the selection of breeding stock. All sow-testing programs begin with the ear-notching of the pigs.

Often in the fall farmers select the largest gilts to keep as brood

FIGURE 53. *Ear-notching a pig shortly after birth is recommended. (Hufnagle photo. Reprinted from* Successful Farming.)

sow replacements. The gilts may have been large because there were only three or four pigs raised in the litter. Unless the litters are marked, there is no way of knowing the kind of a litter the gilts came from. The marking of the pigs should be done as they are farrowed, giving all of the pigs of one litter the same ear notch.

Most producers number the litters in the order in which they are farrowed. The first litter farrowed is No. 1, the second litter farrowed is No. 2, and so forth. The notches may be made by using a notching instrument or scissors. It is also a good practice to weigh the pigs as they are being ear-notched.

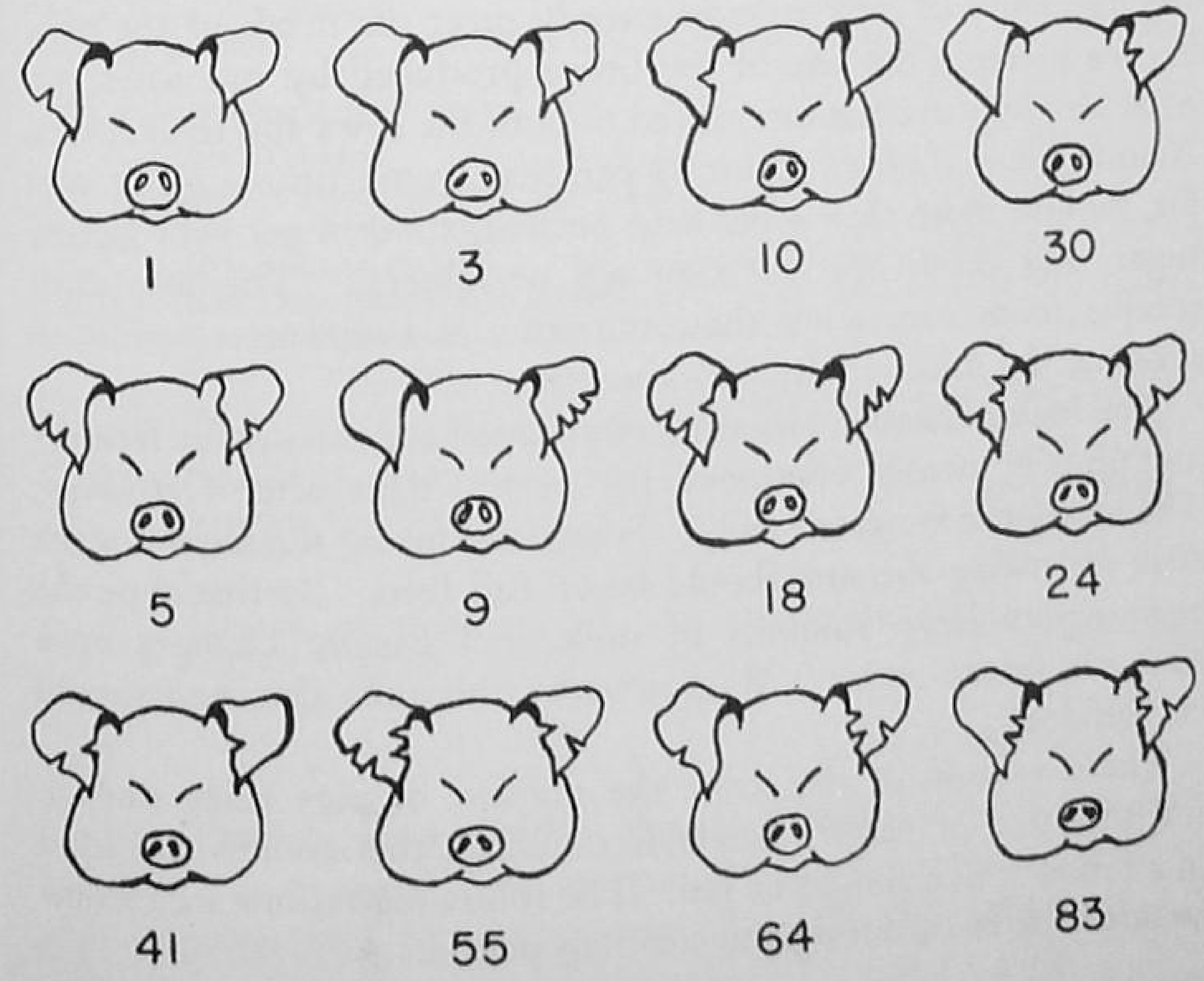
Although there are numerous marking systems, the following is most commonly used:

Standard Ear-Notching System

One notch in the lower right ear is 1
One notch in the lower left ear is 3
One notch in the upper right ear is 10
One notch in the upper left ear is 30

EXAMPLES: Litter No. 2—Two notches in the lower right ear.
Litter No. 14—One notch in the upper right ear, one notch in the lower left ear, and one notch in the lower right ear.

FIGURE 54. *Standard ear-notching system. (Drawing by Francis G. Telshaw.)*



MANAGEMENT DURING THE SUCKLING PERIOD

It was suggested in a previous chapter that only gilts with ten, twelve, or fourteen sound nipples should be kept for breeding purposes, and that the gilts should be from large litters which were heavy at weaning and market time. Sows with these characteristics are likely to be good mothers during the suckling period. The weight of the pigs at weaning time is a good indication of the inherited growth ability of the pigs, and of the ability of the sow to produce milk. It has been estimated that from 20 to 30 per cent of pigs that are farrowed fail to reach a weaning age of eight weeks. Although many of the pigs die because they are lain upon, injured, diseased, or chilled, we know that many of them die because they do not receive sufficient milk and other feeds. The ration given the sow, the ration provided for the pigs, the pasture available, and the management given the sow and litter determine whether or not we save a high percentage of the pigs in the litter and have them at a heavy weight at weaning time.

Feeding. *Feeding the sow.* A sow when fed a good ration may produce from 6 to 8 pounds of milk per day. When the size of litter is small, 5 or 6 pounds of milk may be sufficient. Sows, however, which are nursing from ten to twelve pigs must produce the maximum of milk to satisfactorily meet the needs of the pigs. As we increase the size of the litters produced by our sows, we must also improve the rations fed to both the sows and their litters. A sow's milk contains about 81 per cent water, nearly 6 per cent fat, slightly more than 6 per cent protein, about 6 per cent lactose sugar, and about one per cent ash or mineral. The sow must receive feeds containing these nutrients in sufficient amounts to produce the milk required by the litter.

The bulky, laxative ration recommended for the sow at farrowing time is usually continued for several days after farrowing. The amount is increased daily. Sometime during the second week after farrowing the sow should be on full feed. By that time the pigs require large amounts of milk, and usually changes must be made in the ration. Most sows by this time can, and should be, self-fed.

The condition of the sows, the number of pigs being nursed, and the type of pasture available influence the amount and kind of a ration which should be fed. The following rations are recommended for sows during the suckling period:

Sows in Dry Lot

Ration 1

	Pounds
Ground corn, grain sorghum, or barley	65
Ground oats or wheat	11.5
Alfalfa meal	10
Tankage	13
Mineral	.5
Total	100

Ration 2

	Pounds
Ground corn	600
Ground oats	600
Alfalfa meal	600
Tankage or sow and pig supplement	200
Total	2000

Sows on Pasture

Ration 1

	Pounds
Ground corn, grain sorghum, or barley	77
Ground oats or wheat	16.5
Tankage or meat scraps	6
Mineral	.5
Total	100

Ration 2

	Pounds
Ground corn or grain sorghum	630
Ground oats or wheat	150
Meat scraps	80
Soybean oilmeal	40
Mineral	10
Total	910

Complete Rations for Self Feeding Sows and Litters
(Balanced Swine Rations, Iowa State College)

	In Dry Lot	*On Pasture*
Ground corn	1200 lbs.	1300 lbs.
Ground oats	400 lbs.	400 lbs.
Sow and pig supplement	400 lbs.	300 lbs.
Per cent protein	(14.5%)	(13.0%)

SOW AND PIG SUPPLEMENT:

60% Tankage	300 lbs.
44% Soybean oilmeal	950 lbs.
41% Cottonseed meal	100 lbs.
34% Linseed meal	100 lbs.
17% Dehydrated alfalfa meal	300 lbs.
Ground limestone	60 lbs.
Steamed bonemeal	110 lbs.
Salt	40 lbs.
Trace mineral mix	15 lbs.
Vitamin D_2	4 million units
Vitamin B_{12}	60 milligrams
Riboflavin	12 grams
Niacin	70 grams
Calcium pantothenate	12 grams
Choline chloride	450 grams
Antibiotics	60 grams
Total	1975 lbs.

Creep-feeding young pigs. Pigs will begin to nibble at feeds when a few days old and can consume considerable feeds by the time they are two or three weeks old. The milk production of

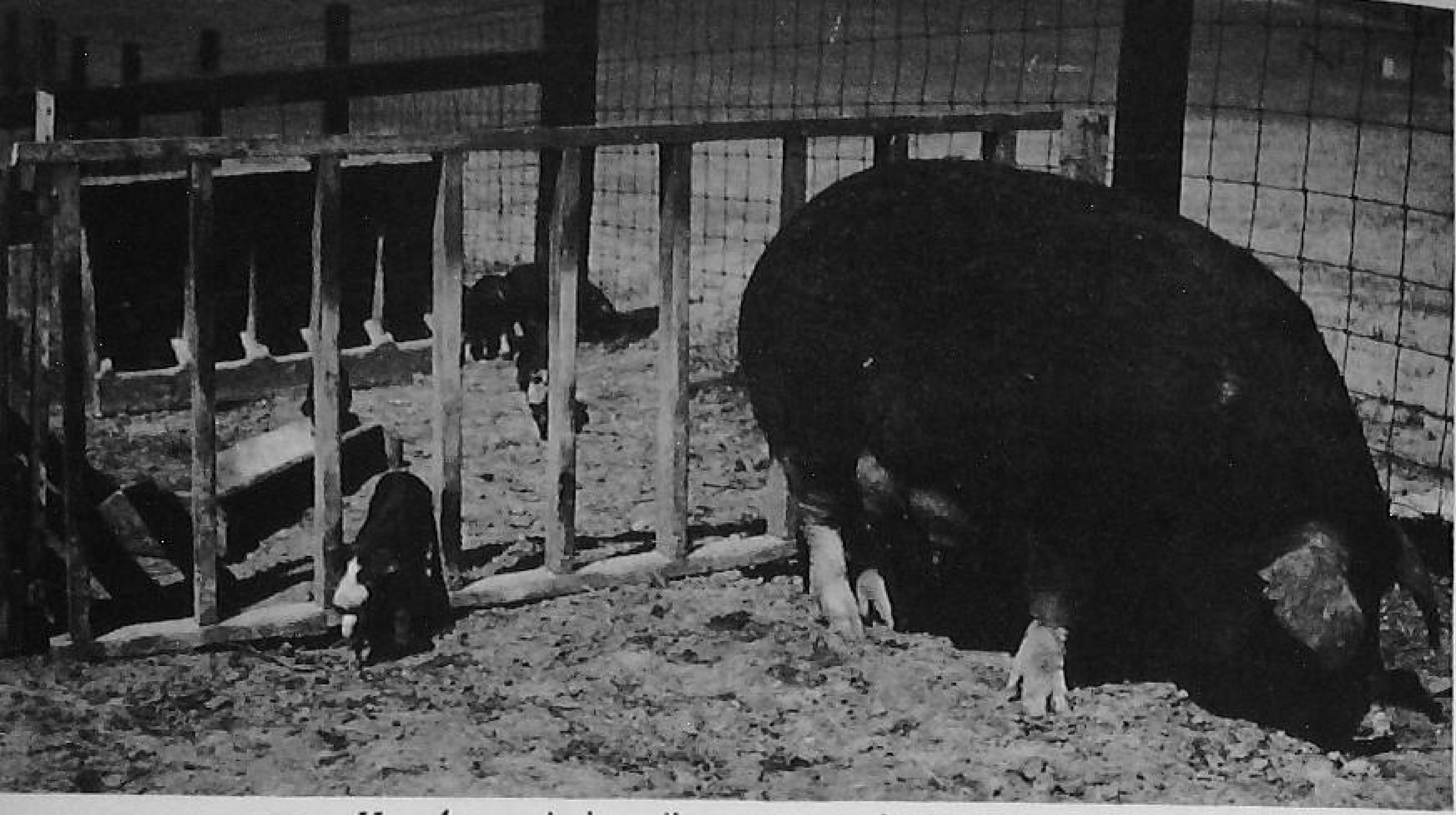


FIGURE 55. *A practical, easily constructed pig creep. (Courtesy University of Wisconsin.)*

the sow usually declines after the third week, and it is important that the little pigs be fed a palatable ration in ample amounts. This is especially true when sows are suckling large litters, and when the sows are in poor condition.

The little pigs need a more palatable ration, higher in protein and in antibiotics and lower in fiber content, than do their mothers. As a result, the feeding of the pig starters or creep rations are recommended. These rations should be fed in a trough or feeder in a pen separate from that of the mother. The gates may be adjusted so that the pigs can get in but the sows cannot.

Pig starters. Cracked corn, hulled oats, or rolled oats are very palatable to young pigs and are good feeds to begin with in creep-feeding. Numerous pig starters are now on the market which contain in addition to grains, protein supplement, minerals, vitamins, antibiotics, and sugar.

Recent tests show that pigs have a sweet tooth. The addition of sugar to the ration increases its palatability, its nutritive value, and the quantity of feed consumed by the pigs. Tests conducted at Iowa State College indicated that it was possible to produce 49-pound pigs at eight weeks of age by taking the pigs from the sow at three days of age and feeding them synthetic milk and a pig starter containing 5 per cent sugar. Each pig consumed a total of 60 pounds of starter and 22 pounds of synthetic milk solids.

Pig starters should be well fortified with proteins, sugar, vitamins, antibiotics, and trace minerals. Ordinary table-grade sugar, brown sugar, or blackstrap molasses increases the palatability of

the starters. The percentage of sugar in the total ration may be from 5 to 15 per cent.

Pigs like pellets better than meals or crumbled feeds. Dusty or finely ground feeds are not eaten readily. Most pig starters on the market are in pellet form, and it has been found that pigs will consume nearly twice as much feed in pellet form as in the form of meal. Some tests have shown that the pigs will eat more sugar-coated pellets than pellets with the sugar mixed with the feed.

A good pig starter should contain from 16 to 20 per cent protein, 3 to 4 per cent fat, not more than 3.5 per cent fiber, one per cent calcium, .6 to .8 per cent phosphorus, and .5 per cent salt. It should be fortified with the following:

Antibiotics	20 or more milligrams per pound
Trace minerals	.1 to .2 per cent
Vitamin A	3000 to 4000 international units per pound
Vitamin D_2	400 international units per pound
Riboflavin	3 to 4 milligrams per pound
Niacin	20 to 30 milligrams per pound
Pantothenic acid	7 to 10 milligrams per pound
Choline	450 milligrams per pound
Vitamin B_{12}	10 micrograms or more per pound

A commercial pig starter in pellet form is probably the best means of satisfying the nutritional needs of pigs during the suckling period, providing a high-quality feed can be obtained at a reasonable price. The following rations are recommended for those who wish to mix their own pig starters:

Ration 1

(Recommended by R. J. Meade, University of Illinois[1])

	Pounds
Rolled oats	40
Ground yellow corn	30
Corn sugar	10
Meat scraps	5
Soybean oilmeal	5
Dried skim milk	10

Antibiotic feed supplement may be added to supply 1.5 grams of antibiotic activity per 100 pounds of ration.

Ration 2

(Recommended by specialists at Iowa State College)

Yellow corn coarsely ground	150 lbs.
Rolled oats	1000 lbs.
Sugar	300 lbs.
60% Fish meal or 50% meat and bone scraps	50 lbs.

[1] R. J. Meade, *Feeding and Managing the Sow and Litter*, AS259, University of Illinois, Jan. 1952.

Dried whey	50 lbs.
Soybean oilmeal	400 lbs.
Ground limestone	15 lbs.
Steamed bonemeal	30 lbs.
Salt	10 lbs.
Trace mineral mix	4 lbs.
Vitamin A	6 million units
Vitamin D_2	1 million units
Vitamin B_{12}	40 milligrams
Riboflavin	6 grams
Niacin	60 grams
Calcium pantothenate	6 grams
Choline chloride	150 grams
Antibiotics	40 grams
Total	2009 lbs.

Feeding synthetic milk. The feeding of synthetic milk to pigs has been highly publicized during the past few years. It has been found that the loss of pigs between farrowing and weaning may be decreased by leaving the pigs with the sow for only two or three days after farrowing, after which they are taken from the sow and fed a ration of synthetic milk and pig starter. A number of synthetic milk products are on the market which, when fed properly, will replace sow's milk after the first few days of the nursing period. The first milk produced by the sow, the colostrum, contains proteins, vitamins, and antibodies which give the pigs a good start and protect them from diseases. Pigs usually will not live unless they get some colostrum, so they should not be put on synthetic milk rations until they are a few days old.

It is doubtful that synthetic milks will ever completely replace the sow's milk in raising pigs. The sow is an efficient producer, and many problems are encountered in raising pigs on synthetic products. Heat must be furnished for the first week at least, and sanitation is very important. The pigs must be fed several times a day, which involves a labor problem.

Theoretically, if it were possible to rebreed the sows three days after farrowing, it would be possible to raise three litters from each sow each year if pigs were removed from the sow at three days of age. Tests indicate, however, that sows do not normally conceive when bred three days after farrowing. When bred two to four weeks later, the sows do conceive but too late to raise three litters in one year. It is doubtful that the average farmer will try to produce more than two litters per sow per year.

Synthetic milks certainly help to save orphan pigs and pigs from

FIGURE 56. *Feeding pigs synthetic milk.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

exceedingly large litters if the sows are poor milkers. Careful hogmen are using synthetic milk products effectively in feeding large numbers of pigs. Some pig hatcheries are using these products with good results. We are not ready, however, to recommend that the average farmer do away with sows for suckling the pigs produced on his farm.

Extreme care should be taken in feeding the litter artificially. The following practices are "musts" in raising pigs on synthetic milks and pig starters:

1. Use a farrowing stall for at least the first three days.
2. After three days, move the sow and litter to a regular pen which has a brooder or heat lamp.
3. Keep the pigs with the sows for at least three days and preferably for two or three weeks. The pigs need the colostrum milk.
4. Purchase a highly fortified synthetic milk. The quality of the product is important.
5. Reconstitute or mix the milk with warm water, and self-feed for the first two days. The temperature should be about 85 degrees F.
6. After two or three days, gradually decrease the temperature until it is constant and cool.
7. Be sanitary. Clean and disinfect with boiling water daily

all feeding equipment. Keep the pen clean and well bedded.

8. To teach pigs to drink just dip their noses in the warm milk once or twice.
9. Put no more than ten pigs in one pen during the first three weeks. Each pig should have at least 3 square feet of floor space. After the fourth week each pig should have 6 square feet of floor space, and fifteen or twenty pigs may be placed in the same pen.
10. During the first few weeks, provide heat by the use of brooders or heat lamps. Avoid drafts and dampness. A chilled pig quite often becomes a dead pig.
11. Full-feed synthetic milk in troughs or in automatic chicken fountains for the first three weeks.
12. Feed a good pig starter in a creep in addition to the milk after the first week. By the time the pigs are three weeks old they will have no need for the sow. The quality of milk can be reduced as the pigs consume increased amounts of the pellet starter.
13. Keep plenty of fresh water before the pigs.

Anemia. Small pigs which have had little exercise and no opportunity to pick up iron and copper from the soil may develop anemia. Anemia in pigs is a blood condition usually caused by a lack of copper and iron. A large number of pigs die each year due to this trouble.

The anemic pigs usually show a loss of appetite, become weak, have trouble breathing, and sometimes have a swollen condition around the head and shoulder. Sometimes they "thump."

FIGURE 57. *Sod is provided to prevent anemia. (Courtesy Rath Packing Company.)*

There are at least three ways of preventing anemia. First, pigs which are raised in the late spring or summer and have access to earth and sod do not get anemia. The little pigs get enough iron and copper from the sod to satisfy their needs. Second, if the pigs are confined and cannot get sod, bring it to them. Get the sod from a disease-free field or from along the roadside. It is a good tonic for the pigs when they are just a few days old. Keep sod before them until they can get out on clean-ground pasture.

The third method of controlling anemia is to use drugs obtained from the drug store or veterinarian. Iron and copper pills, which can be given each pig when about five days old and weekly thereafter, are available. The udder of the sow may be brushed daily with a solution of copperas (ferrous sulfate), which can be purchased at any drug store. Some hogmen mix copperas with the feed given the sow during pregnancy and nursing periods. When fed this way it is mixed carefully at the rate of 1½ ounces of copperas per 100 pounds of feed. Ohio State University recommends using one pound of copperas to 100 pounds of creep ration.

Castration. Pigs should be castrated when they are from two to three weeks of age. They recover from the operation very quickly at this age. The later we castrate, the greater the setback. Under no conditions should the pigs be castrated, wormed, vaccinated, or weaned at the same time. These operations should be spaced at two-week intervals.

Unless heat is provided by use of brooders or heat lamps, pigs should be castrated when the weather is warm. The hog house and pen should be clean, dry, and well bedded.

Two persons are needed in castrating—one holds the pig while the other operates. The pig may be held by a front and a hind leg on opposite sides with its back on the floor, or by the hind legs with its head and shoulders between the assistant's knees. The scrotum should be washed with a mild antiseptic solution or with soap and water. The sharp knife used in castrating and the operator's hands or rubber gloves should be carefully cleaned and disinfected.

The incision may be made over each testicle, or in between the testicles, parallel to the middle line of the body. The incision should pass through the skin near the top of the testicle and through the testicle covering. The testicle is pulled slowly through the incision and the attachments are separated with little bleeding.

The second testicle is removed in the same manner.

Care should be taken to make the incision fairly long so that it will drain well. As much of the cord should be removed as possible. Usually there is no need to apply disinfectant or healing oil after the operation.

When mature boars are castrated, it is usually necessary to throw them and tie their legs. The operation is similar to that on pigs but there is more danger of bleeding.

Sometimes pigs are ridglings or "originals." They have but one testicle in the scrotum. It is often best to turn over these pigs, as well as those that are ruptured, to a veterinarian.

Vaccination. In most areas the vaccination of pigs for hog cholera is cheap insurance against loss. This should be done about two weeks after castration and two weeks before weaning, if the double treatment is to be used. Although new vaccines are being developed, at the present time the double treatment is most commonly used in many of the hog-producing areas. If the single treatment is to be used, it should not be given until at least two weeks after the pigs have been weaned. Some of the new rabbit-

FIGURE 58. *Vaccinating a pig for hog cholera about two weeks before weaning time. (Hufnagle photo. Reprinted from* Successful Farming.)

FIGURE 59. *A Hamprace or Montana No. 1 litter on pasture. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

adapted virus vaccines may be given previous to weaning. With the double treatment, a 20- to 30-pound pig requires about 20 to 25 cc. of serum and 2 cc. of virus. A 40- to 75-pound pig will need 30 cc. of serum and 2 cc. of virus to produce an immunity.

In some communities erysipelas has been a problem, and it is necessary to have the veterinarian double-treat the pigs for this disease when they are from three to seven days of age.

Pasture. The sows and litters should be moved to clean legume pasture as soon as possible after the pigs are a week or two old. Because of cold weather and the required electricity it may be necessary to postpone the moving of the litter, but the sooner the sow and the pigs can get out on good pasture, the better.

Care should be taken in moving pigs to pasture so that no infections are picked up enroute. It is better to haul the sow and litter than to drive them. On some farms concrete runways have been provided for this purpose. They can be cleaned easily and permit the pigs to travel back and forth from the farrowing house to the pasture without picking up infections in old lots.

Weaning. With the use of synthetic milks and fortified pig starters, it is possible to wean the pigs in advance of the usual age of eight weeks. Many pigs will be weaned at five or six weeks of age.

Normally it is best to remove the sow from the pigs rather than to place the pigs in new quarters. Pigs should not be weaned until they are consuming rather large amounts of starter feeds and grain. When skim milk and buttermilk are available they make excellent feeds during the weaning period.

Weighing Pigs at Fifty-six Days. The weight of the pigs at fifty-six days determines almost accurately the productiveness of the individual sows and the effectiveness of the breeding, feeding, and management programs. The litter weights are very helpful in planning rations for the pigs after weaning, and in planning rations for the sows to be used in producing the next crop of pigs. The selection of gilts and sows to be retained in the herd should be based upon the litter weights. The tried sows to be kept over for second and third litters should be those which produce the best litters. Untried breeding animals are always a risk. By selecting gilts from litters which were heavy at fifty-six days, much of this risk can be removed.

FIGURE 60. *Weighing pigs at 56 days using a dairy scale. (Courtesy United Duroc Record Association and Tracy Brothers.)*

A bathroom scale, or a scale supported by a tripod, may be used in weighing. A good litter should average from 35 to 40 pounds at fifty-six days of age, and there should be at least eight pigs weaned.

MANAGEMENT OF PIGS FROM WEANING TO MARKET

Approximately one-third of the total cost of producing a 220-

pound market hog is involved in raising the pig to weaning age. It takes the remaining two-thirds of the total cost to grow out the pig from weaning time until it is ready for market. From the production standpoint, the period from weaning to market is an important one since more than twice as much capital is involved in this period as is involved in producing weaning pigs. Serious losses can occur during this period as a result of poor feeding and management, or as a result of a disease outbreak.

The efficient hog raiser plans carefully his production program. He provides adequate rations and feeds them in the proper amounts. He uses the methods of feeding best suited to his farm situation. He provides pasture of good quality in the desired amount. He is efficient in housing his hogs and in controlling diseases and parasites. The profit from the enterprise is determined by the cost of production and by the selling price. Usually he can influence the cost of production more easily than he can the selling price.

Worming. Most farms are contaminated with round worms, which are injurious to swine. This parasite is discussed fully in the following chapter, but we wish to mention here the need for worming most pigs when they are placed on pasture.

Round worms may be controlled by the use of rotated pastures, but we are never certain that the mature animals in the herd are free from the parasites. The only safe way is to treat the pigs for worms even though we have used the McLean County clean-ground system of rotated pastures.

Many drugs and other materials for worming purposes are sold commercially. One of the best wormers is sodium fluoride, which must be fed mixed with dry feeds. It is very poisonous, and must be thoroughly mixed with ground grain. It should never be fed in slop feeds.

Two methods are used in treating pigs with this drug. The first method involves the mixing of one pound of sodium fluoride with 99 pounds of ground grain. There should be enough feed mixed to feed the pigs for one day, and feeder space should be provided so that each pig can get its share. The pigs should get no other feed, and at the end of a twenty-four-hour period the leftover, treated feed should be removed.

The second method is a variation of the first. One pound of sodium fluoride is mixed with 200 pounds of dry feed, and the pigs are permitted to eat the feed for two days instead of for one. The

mixture is removed after the second day. In both methods the pigs should have access to plenty of fresh water at all times.

Pastures for Swine. Green pastures are rich in vitamins, fairly rich in minerals, and supply proteins which are often lacking in grains and mill feeds. The use of good pastures also promotes good digestion and provides healthful sunlight and exercise. As pointed out previously, pigs should be moved to good pasture as soon as possible after farrowing.

Pastures save feed. A good pasture can save from 10 to 20 per cent of the grain and concentrate necessary to grow out a pig. Purdue tests indicate that a good legume pasture can cut down the grain required for growing and fattening hogs from 5 to 10 per cent and reduce the protein supplement by 30 to 40 per cent. In Wisconsin one acre of alfalfa or rape pasture saved 1800 pounds of corn and 500 pounds of tankage. Based on 1953 prices, the feed cost in raising a market hog to a weight of 200 pounds amounts to from $24 to $30. A saving of 10 per cent would amount to from $2.40 to $3.00 per pig. An acre of good legume pasture will carry twenty pigs from weaning to market, with a full feed of grain and supplement; an acre of pasture then will save from $48 to $60 worth of feed.

Pastures produce better carcasses. The kind of feeds fed to hogs has an important influence upon the kind of carcasses which will be produced. The ration must have muscle-building elements, the proteins, if lean meat is to be produced. The exercise which a hog receives while on pasture and the proteins consumed while eating the forage aid in producing a meatier, better muscled carcass. The gains may not be quite as rapid on pasture as in dry lot, but the carcasses will often be firmer and better muscled. The use

FIGURE 61. *Chester White pigs with movable equipment on rotated pasture in Ohio. (Courtesy Chester White Swine Record Association.)*

of more and better pastures on the average farm is one means of improving the quality of pork available to the consumer at the meat counter.

Kinds of hog pastures. Ladino clover, alfalfa, red clover, lespedeza, and birdsfoot trefoil are our best legume hog pastures. Rye, oats, timothy, sudan grass, brome grass, and rape are nonlegumes which have a place in our hog production programs. Bluegrass dries up during the middle of the summer when pasture should be plentiful. It does provide excellent early and late pasture. Sweet clover is not as palatable as are the other legume pastures and becomes coarse during the late summer and fall.

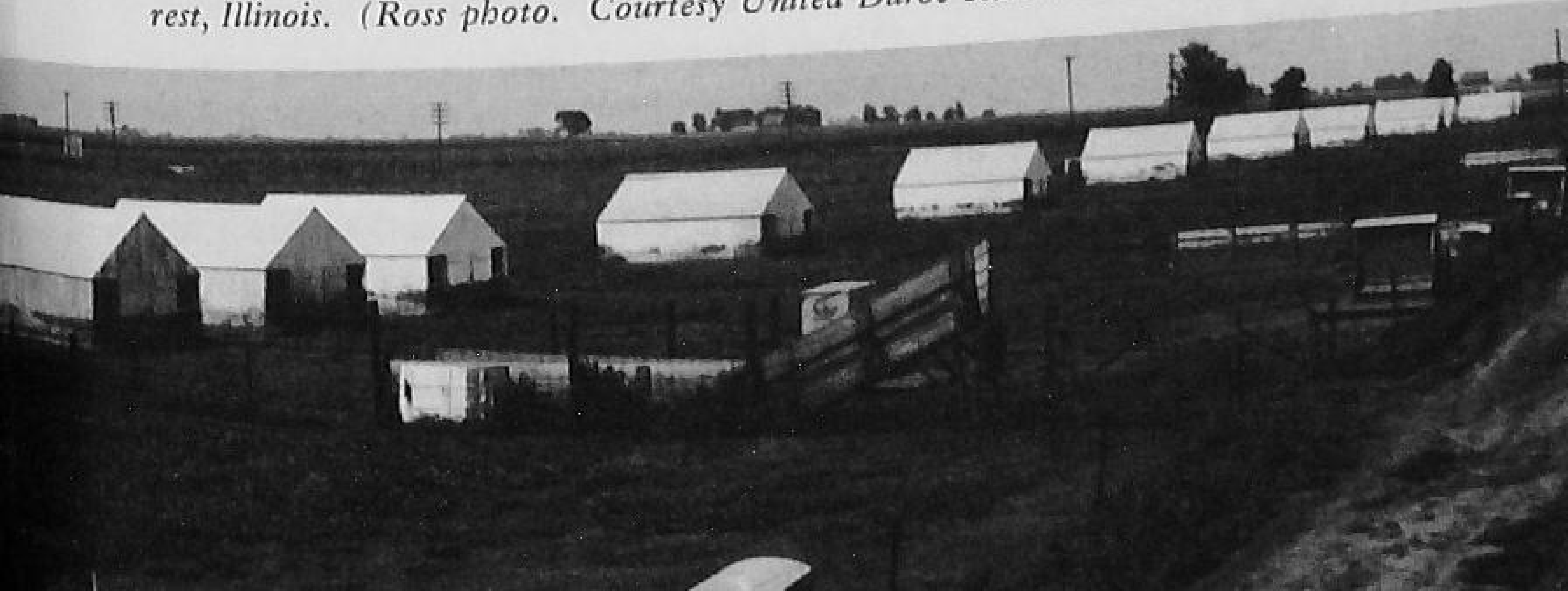
One of the best pasture crops for hogs is a mixture of ladino clover and alfalfa. On dry spots, and during dry years, the ladino will not do well, but the alfalfa will be productive. In good years the alfalfa will help to hold up the ladino. Tests conducted in Indiana in 1948 and 1949 indicated that ladino was a better pasture crop for pigs than was alfalfa. Pigs on alfalfa needed 301 pounds of corn and 37 pounds of supplement to produce 100 pounds of gain. Pigs on ladino required only 297 pounds of corn and 26 pounds of supplement to produce 100 pounds of gain.

Ladino has a shallow root and is best suited to moist soils. Alfalfa does well on dry soils. Ladino is not as winter-hardy as is hardy alfalfa, and may winter-kill in the extreme northern states. Both alfalfa and ladino respond to applications of lime and to phosphate fertilizers.

In seeding ladino with alfalfa, from ½ to one pound of ladino and from 7 to 10 pounds of alfalfa seed are seeded per acre.

Red clover makes an excellent pasture for pigs but does not produce the tonnage of forage produced by alfalfa and ladino. Purdue

FIGURE 62. *Ladino clover for sows and litters at Honegger's Pig Hatchery, Forrest, Illinois. (Ross photo. Courtesy United Duroc Record Association.)*



tests indicated that pigs on red clover pasture required 352 pounds of concentrates to produce 100 pounds of gain as compared to 344 pounds needed by the pigs on alfalfa. About 8 pounds of red clover should be seeded per acre.

Birdsfoot trefoil ranks with alfalfa in palatability, in feed value, and in ability to stand drouth. It does well seeded with bluegrass as a permanent pasture crop. Often two to three years are required to get a stand, but it will last for many years. The usual rate of seeding is from 4 to 5 pounds of inoculated seed per acre.

The nonleguminous crops, oats, rape, brome grass, sudan grass, and rye, should be used only as emergency crops when the legumes winter-kill or when new seedlings do not survive dry weather. Rye provides a very early pasture in the spring but dries up in the early summer. Rape does not provide an early pasture but does make an excellent late pasture.

In tests conducted at Iowa, Illinois, Indiana, and Wisconsin experiment stations, pigs on rape pasture ate 349 pounds of concentrates in producing 100 pounds of gain. Pigs on red clover ate 359 pounds. Rape should be seeded at the rate of about 6 pounds per acre.

Pasture management. In order to prevent disease and parasite outbreaks, it is desirable to provide a new pasture area each year. Farmers who make new seedings each year have a new pasture area for each crop of pigs. There is no danger of the pigs picking up worm eggs or infections on the new pasture area.

Farmers who use permanent or semi-permanent pastures accomplish the same result by dividing the pasture area into three or four parts, and then rotating the use of the divided areas. For best result pigs should not be raised on the same pasture more often than once in three or four years.

Feeding Pigs on Pasture. Most rapid and economical gains are usually brought about by full-feeding pigs which have access to good legume pasture. When feeds are high in price or scarce in quantity, it is sometimes desirable to feed a limited ration and make more effective use of the pasture. The rate of gain is decreased, and it takes the pigs a longer time to reach a marketable weight. The quality of the carcasses produced, however, may in some cases be improved. Each hog raiser must decide which of the two systems will be most profitable on his individual farm.

Methods of feeding. Pigs may be hand-fed or self-fed. Self-

feeding saves labor and usually produces more rapid and economical gains than does hand-feeding. Self-feeding also promotes sanitation and provides large feed storage space. Self-feeders, however, are expensive and are sometimes neglected by irresponsible caretakers. Sometimes the use of the self-feeders decreases the effect of good pasture because the appetites of the pigs are satisfied while they are at the feeders. Some farmers prefer to

FIGURE 63. *A 260-bushel self-feeder. It is 4 feet wide, 14 feet long, 7 feet high in front and 6 feet high at the back. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

hand-feed their pigs. They can watch them more closely and can feed types of feeds which cannot be self-fed, such as ear corn and slop feeds. The practice of slopping pigs is still quite popular among some farmers. It is possible to get pigs to consume more feed by mixing it with water or milk, providing it is fed as a wet mash rather than as a thin slop. Slop or wet mash feeding also encourages the pigs to consume more water.

Farmers who produce large numbers of pigs usually self-feed, whereas farmers with fewer pigs may be able to practice hand-feeding. Slop or mash feeding necessitates the grinding of the feeds. When ear corn is fed, it usually must be hand-fed. Some farmers self-feed the ground feed and concentrate, and hand-feed ear corn.

If pigs are to be hand-fed, feed at one time only the amount of feed that they will clean up in an hour or two. This is especially important if slop or wet mash feeding is practiced. Stale feed in the trough is not only wasteful, but it is also unappetizing and

FIGURE 64. *Quick filling of hog feeders with an auger-type unloading wagon. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

decreases the amount of feed that the pigs will consume.

Self-feeders. A good self-feeder should make available to the pigs a supply of clean, dry feed at all times. It should be solidly constructed, and protect the feed from wind or rain. It should be large enough to store amounts of feed which will last the pigs for several days. It should have an adjustable throat or opening, and some type of agitator, so that various types of feeds will feed down in desired amounts. The trough should be constructed in such a manner that little feed will be wasted. Doors or lids over the troughs are desirable. If the ration is fed as a complete mixed ration, only one feeder will be needed. If feeds, such as shelled corn, ground oats, and supplement, are fed separately, separate feeders will be needed, or separate compartments in a large feeder may be used.

The use of large feeders which will handle 250 bushels of shelled corn and 1500 pounds of supplement will cut down the cost of feeding equipment and will save labor. Twenty feet of feeder space will accommodate approximately 150 pigs.

Rations. Farm grains should make up the main part of the ration. Corn, when available, produces the most rapid and economical gains. Barley, wheat, oats, and grain sorghums may be fed but should be ground. These feeds produce slower gains but may produce better carcasses.

A common practice in the Corn Belt is to feed rations made up quite largely of corn supplemented with tankage and soybean oilmeal, or with a mixed protein feed. It is a good practice to feed

some oats, wheat or wheat mids, or barley with the corn. From 10 to 30 per cent of the ration may be made up of grains other than corn. These other grains provide variety and add to the palatability of the ration in addition to supplying needed nutrients.

In areas where corn is not obtainable, it is possible to build good rations by using ground or soaked barley or ground grain sorghums.

Since the grains and pasture cannot provide all the proteins, vitamins, and minerals necessary, we must supply sufficient feeds to meet the nutritional needs of the pigs. Protein and mineral supplements which have been fortified with vitamins and antibiotics must be added.

Proteins. It was pointed out in Chapter 1 that proteins are made up of amino acids and that ten of these amino acids are essential for animal health. Corn, which is the basic grain fed to hogs in much of the Corn Belt, is low in two of these essential amino acids, lysine and trypotophan. Therefore, it is necessary to supplement corn with protein feeds high in these two amino acids. Most proteins of plant origin are deficient in lysine. The exception is soybean oilmeal, which is a good source of lysine. Animal proteins, such as tankage, meat scraps, and fish meal, are also good sources of this amino acid. A good protein supplement then should contain soybean oilmeal or a meat origin protein, or both.

Plant proteins, in general, are good sources of tryptophan, whereas meat and bone scraps, if fed alone with corn, will not provide an adequate amount of this amino acid for maximum growth. Most mixed protein and mineral supplements contain several protein feeds of plant origin which provide an adequate supply of tryptophan.

Numerous tests have been conducted to determine the value of protein supplements in feeding pigs. In general, protein feeds are more important in feeding pigs weighing from 45 to 85 pounds than in feeding those weighing 100 pounds and over. Light pigs fed corn alone will gain less than ⅓ pound per day. The same pigs fed a protein supplement will gain more than a pound a day. Heavier pigs fed corn alone will require about 200 pounds more feed to produce 100 pounds of gain than will pigs fed corn and a protein supplement. Tests show that 100 pounds of tankage may save from 500 to 600 pounds of corn.

Protein feeds are more important in feeding pigs in dry lot than in feeding those on pasture. The use of good legume pastures can

reduce the amount of protein concentrates by nearly 50 per cent.

Until the discovery of vitamin B_{12}, it was necessary to provide rations containing from 18 to 20 per cent protein for weanling pigs. By adding B_{12} we can reduce this percentage to 14 per cent, providing the ration is well balanced. The amount of protein necessary for heavier hogs can be reduced proportionally by the addition of this vitamin. Pigs weighing from 75 to 150 pounds require 12 per cent protein rations; heavier hogs, from 150 to 200 pounds, require 10 per cent rations if the rations are balanced and vitamin B_{12} has been added. The addition of B_{12} in the ration can reduce the amount of protein supplement to the extent of about 80 to 110 pounds of 40-per-cent supplement saved per 240-pound market hog. Be certain that you feed a protein supplement containing vitamin B_{12}.

Following are examples of recommended protein supplements for pigs on pasture and on dry lot:

Ration 1

(Purdue Supplement 5—for pigs on dry lot)

	Per Cent
Meat and bone scraps	20
Menhaden fish meal	20
Soybean oilmeal	40
Cottonseed meal	10
Alfalfa leaf meal	10
	100

Ration 2

(Cornell No. 2—for pigs on dry lot)

	Per Cent
Meat scraps, tankage or fish meal	30
Soybean oilmeal	40
Ground alfalfa	26
Ground limestone	2
Iodized salt	2
	100

Ration 3

(Cornell No. 7—for pigs on pasture)

	Per Cent
Tankage or meat scraps	20
Fish meal	20
Soybean oilmeal	40
Linseed oilmeal	20
	100

Ration 4

(Purdue Supplement C—for pigs on pasture)

	Per Cent
Meat and bone scraps	20
Fish meal	20
Soybean oilmeal	40
Cottonseed meal	10
Linseed meal	10
	100

Antibiotics and minerals are discussed later on in this chapter. It is suggested that these materials be mixed with the protein supplement and be self-fed. A hog will balance his own ration if given an opportunity. For pigs weighing from 75 to 150 pounds, 86 pounds of corn and 14 pounds of 40-per-cent protein supplement will make the recommended 12-per-cent protein ration. For

TABLE 9

Amount of Supplement of Different % Protein Needed with Corn to Formulate Rations of Different Levels of Protein *

(Shelled Corn *Only* Figured at 8.5% Protein)

% Protein in Supplement		*% Protein in Total Ration* 10	11	12	13	14	15	16	17	18	19	20
30	Grain (lb.)	1860	1767	1674	1581	1488	1395	1302	1209	1116	1023	1070
	Suppl. (lb.)	140	233	326	419	512	605	698	791	884	977	930
	Lb. Grain per 1 Lb. Suppl.	13.3	7.6	5.1	3.8	2.9	2.3	1.9	1.5	1.3	1.0	1.2
31	Grain	1867	1778	1689	1600	1511	1422	1333	1244	1156	1067	1022
	Suppl.	133	222	311	400	489	578	667	756	844	933	978
	Lb. Grain per 1 Lb. Suppl.	14.0	8.0	5.4	4.0	3.1	2.5	2.0	1.6	1.4	1.1	1.0
32	Grain	1872	1787	1702	1617	1532	1447	1362	1277	1191	1106	1021
	Suppl.	128	213	298	383	468	553	638	723	809	894	979
	Lb. Grain per 1 Lb. Suppl.	14.6	8.4	5.7	4.2	3.3	2.6	2.1	1.8	1.5	1.2	1.0
33	Grain	1877	1796	1714	1633	1551	1469	1388	1306	1224	1143	1061
	Suppl.	123	204	286	367	449	531	612	694	776	857	939
	Lb. Grain per 1 Lb. Suppl.	15.3	8.8	6.0	4.4	3.5	2.8	2.3	1.9	1.6	1.3	1.1
34	Grain	1882	1804	1725	1647	1569	1490	1412	1333	1255	1176	1098
	Suppl.	118	196	275	353	431	510	588	667	745	824	902
	Lb. Grain per 1 Lb. Suppl.	15.9	9.2	6.3	4.7	3.6	2.9	2.4	2.0	1.7	1.4	1.2
35	Grain	1887	1811	1736	1660	1585	1509	1434	1358	1283	1208	1132
	Suppl.	113	189	264	340	415	491	566	642	717	792	868
	Lb. Grain per 1 Lb. Suppl.	16.7	9.6	6.6	4.9	3.8	3.1	2.5	2.1	1.8	1.5	1.3
36	Grain	1891	1818	1745	1673	1600	1527	1455	1382	1309	1236	1164
	Suppl.	109	182	255	327	400	473	545	618	691	764	836
	Lb. Grain per 1 Lb. Suppl.	17.3	10.0	6.8	5.1	4.0	3.2	2.7	2.2	1.9	1.6	1.4
37	Grain	1895	1825	1754	1684	1614	1544	1474	1404	1333	1263	1193
	Suppl.	105	175	246	316	386	456	526	596	667	737	807
	Lb. Grain per 1 Lb. Suppl.	18.0	10.4	7.1	5.3	4.2	3.4	2.8	2.4	2.0	1.7	1.5
38	Grain	1898	1831	1763	1695	1627	1559	1492	1424	1356	1288	1220
	Suppl.	102	169	237	305	373	441	508	576	644	712	780
	Lb. Grain per 1 Lb. Suppl.	18.6	10.8	7.4	5.6	4.4	3.5	2.9	2.5	2.1	1.8	1.6
39	Grain	1902	1836	1770	1705	1639	1574	1508	1443	1377	1311	1246
	Suppl.	98	164	230	295	361	426	492	557	623	689	754
	Lb. Grain per 1 Lb. Suppl.	19.4	11.2	7.7	5.8	4.5	3.7	3.1	2.6	2.2	1.9	1.7
40	Grain	1905	1841	1778	1714	1651	1587	1524	1460	1397	1333	1270
	Suppl.	95	159	222	286	349	413	476	540	603	667	730
	Lb. Grain per 1 Lb. Suppl.	20.1	11.6	8.0	6.0	4.7	3.8	3.2	2.7	2.3	2.0	1.7
41	Grain	1908	1846	1785	1723	1662	1600	1538	1477	1415	1354	1292
	Suppl.	92	154	215	277	338	400	462	523	585	646	708
	Lb. Grain per 1 Lb. Suppl.	20.7	12.0	8.3	6.2	4.9	4.0	3.3	2.8	2.4	2.1	1.8
42	Grain	1910	1851	1791	1731	1672	1612	1552	1493	1433	1373	1313
	Suppl.	90	149	209	269	328	388	448	507	567	627	687
	Lb. Grain per 1 Lb. Suppl.	21.2	12.4	8.6	6.4	5.1	4.2	3.5	2.9	2.5	2.2	1.9
43	Grain	1913	1855	1797	1739	1681	1623	1565	1507	1449	1391	1333
	Suppl.	87	145	203	261	319	377	435	493	551	609	667
	Lb. Grain per 1 Lb. Suppl.	22.0	12.8	8.9	6.7	5.3	4.3	3.6	3.1	2.6	2.3	2.0
44	Grain	1916	1859	1803	1746	1690	1634	1578	1521	1465	1408	1352
	Suppl.	84	141	197	254	310	366	422	479	535	592	648
	Lb. Grain per 1 Lb. Suppl.	22.8	13.2	9.2	6.9	5.5	4.5	3.7	3.2	2.7	2.4	2.1
45	Grain	1918	1863	1808	1753	1699	1644	1589	1534	1479	1425	1370
	Suppl.	82	137	192	247	301	356	411	466	521	575	630
	Lb. Grain per 1 Lb. Suppl.	23.4	13.6	9.4	7.1	5.6	4.6	3.9	3.3	2.8	2.5	2.2

* Swine Nutrition, A. H. Dept.—ISC, 1953.

TABLE 10

Amount of Supplement of Different % Protein Needed with ¾ Corn and ¼ Oats to Formulate Rations of Different Levels of Protein *

(¾ Shelled Corn at 8.5% Protein and ¼ Oats at 12% Protein)

% Protein in Supplement		% Protein in Total Ration: 10	11	12	13	14	15	16	17	18	19	20
30	Grain (Lb.)	1939	1842	1745	1648	1552	1455	1358	1261	1164	1067	1030
	Suppl. (Lb.)	61	158	255	352	448	545	642	739	836	933	970
	Lb. Grain per 1 Lb. Suppl.	31.8	11.7	6.8	4.7	3.5	2.7	2.1	1.7	1.4	1.2	1.1
31	Grain	1942	1850	1757	1665	1572	1480	1387	1295	1202	1110	1017
	Suppl.	58	150	243	335	428	520	613	705	798	890	983
	Lb. Grain per 1 Lb. Suppl.	33.5	12.3	7.2	5.0	3.7	2.8	2.3	1.8	1.5	1.2	1.0
32	Grain	1945	1856	1768	1680	1591	1503	1414	1326	1238	1149	1061
	Suppl.	55	144	232	320	409	497	586	674	762	851	939
	Lb. Grain per 1 Lb. Suppl.	35.4	12.9	7.6	5.2	3.9	3.0	2.4	2.0	1.6	1.4	1.1
33	Grain	1947	1862	1778	1693	1608	1524	1439	1355	1270	1185	1100
	Suppl.	53	138	222	307	392	476	561	645	730	815	900
	Lb. Grain per 1 Lb. Suppl.	36.7	13.5	8.0	5.5	4.1	3.2	2.6	2.1	1.7	1.5	1.2
34	Grain	1949	1868	1787	1706	1624	1543	1462	1381	1300	1218	1137
	Suppl.	51	132	213	294	376	457	538	619	700	782	863
	Lb. Grain per 1 Lb. Suppl.	38.2	14.2	8.4	5.8	4.3	3.4	2.7	2.2	1.9	1.6	1.3
35	Grain	1951	1873	1795	1717	1639	1561	1483	1405	1327	1249	1171
	Suppl.	49	127	205	283	361	439	517	595	673	751	829
	Lb. Grain per 1 Lb. Suppl.	39.8	14.7	8.8	6.1	4.5	3.6	2.9	2.4	2.0	1.7	1.4
36	Grain	1953	1878	1803	1728	1653	1578	1502	1427	1352	1277	1202
	Suppl.	47	122	197	272	347	422	498	573	648	723	798
	Lb. Grain per 1 Lb. Suppl.	41.6	15.4	9.2	6.4	4.8	3.7	3.0	2.5	2.1	1.8	1.5
37	Grain	1955	1882	1810	1738	1665	1593	1520	1448	1376	1303	1231
	Suppl.	45	118	190	262	335	407	480	552	624	697	769
	Lb. Grain per 1 Lb. Suppl.	43.4	15.9	9.5	6.6	5.0	3.9	3.2	2.6	2.2	1.9	1.6
38	Grain	1956	1886	1817	1747	1677	1607	1537	1467	1397	1328	1258
	Suppl.	44	114	183	253	323	393	463	533	603	672	742
	Lb. Grain per 1 Lb. Suppl.	44.5	16.5	9.9	6.9	5.2	4.1	3.3	2.8	2.3	2.0	1.7
39	Grain	1958	1890	1823	1755	1688	1620	1553	1485	1418	1350	1283
	Suppl.	42	110	177	245	312	380	447	515	582	650	717
	Lb. Grain per 1 Lb. Suppl.	46.6	17.2	10.3	7.2	5.4	4.3	3.5	2.9	2.4	2.1	1.8
40	Grain	1959	1894	1829	1763	1698	1633	1567	1502	1437	1372	1306
	Suppl.	41	106	171	237	302	367	433	498	563	628	694
	Lb. Grain per 1 Lb. Suppl.	47.8	17.9	10.7	7.4	5.6	4.4	3.6	3.0	2.6	2.2	1.9
41	Grain	1960	1897	1834	1771	1708	1644	1581	1518	1455	1391	1328
	Suppl.	40	103	166	229	292	356	419	482	545	609	672
	Lb. Grain per 1 Lb. Suppl.	49.0	18.4	11.0	7.7	5.8	4.6	3.8	3.1	2.7	2.3	2.0
42	Grain	1962	1900	1839	1778	1716	1655	1594	1533	1471	1410	1349
	Suppl.	38	100	161	222	284	345	406	467	529	590	651
	Lb. Grain per 1 Lb. Suppl.	51.6	19.0	11.4	8.0	6.0	4.8	3.9	3.3	2.9	2.4	2.1
43	Grain	1963	1903	1844	1784	1725	1665	1606	1546	1487	1428	1368
	Suppl.	37	97	156	216	275	335	394	454	513	572	632
	Lb. Grain per 1 Lb. Suppl.	53.1	19.6	11.8	8.3	6.3	5.0	4.1	3.4	2.9	2.5	2.2
44	Grain	1964	1906	1848	1791	1733	1675	1617	1560	1502	1444	1386
	Suppl.	36	94	152	209	267	325	383	440	498	556	614
	Lb. Grain per 1 Lb. Suppl.	54.6	20.3	12.2	8.6	6.5	5.2	4.2	3.5	3.0	2.6	2.3
45	Grain	1965	1909	1853	1796	1740	1684	1628	1572	1516	1460	1404
	Suppl.	35	91	147	204	260	316	372	428	484	540	596
	Lb. Grain per 1 Lb. Suppl.	56.1	21.0	12.6	8.8	6.7	5.3	4.4	3.7	3.1	2.7	2.4

* Swine Nutrition, A. H. Dept.—ISC, 1953.

pigs weighing more than 150 pounds, 92 pounds of corn and 8 pounds of 40-per-cent supplement will make a 10-per-cent ration. The amounts of protein supplements and grains needed to make up rations of different levels of protein are shown in Tables 9 and 10. We are indebted to Dr. Damon Catron of the Iowa State College for this information.

Antibiotics. The feeding of antibiotics to pigs from weaning time to market weight will normally result in an increase in gain from 10 to 20 per cent, will save 20 pounds of feed in producing each 100 pounds of gain, will reduce the problem of scours in young pigs, will result in more uniformity of pigs in the litter, and will almost eliminate the runt-pig problem.

The saving in feed, the increase in rate of gain, and the improvement in the health of the pigs makes the feeding of antibiotics a "must" in our pork production programs.

Experimental work at the Iowa and Illinois experiment stations indicate that aureomycin, terramycin, and penicillin antibiotics have yielded the best results, and are about equal in increasing the rate of gain and the efficiency of feed utilization in growing and fattning pigs. The practical level of feeding antibiotics in pig starters seems to be from about 20 to 40 grams of antibiotics per ton of total ration or from 10 to 20 milligrams per pound. (A pound equals 453.6 grams, and a gram equals 1000 milligrams.) Early tests indicated that perhaps the practical level of feeding antibiotics was 10 grams per ton or 5 milligrams per pound. Later tests indicated that these minimums should be doubled in the case of pig starters. Starters which are fed with shelled corn should contain 40 milligrams of antibiotics per pound.

Whereas the feeding of antibiotics will increase the rate of gain in healthy pigs by 10 to 20 per cent, it will increase the gain in unhealthy pigs by as much as 100 per cent. Most farms in the Corn Belt have had diseased hogs at some time and, as a result, have rather high disease levels. The higher the disease level, or the more infection present, the greater the value of feeding antibiotics.

The greatest response to an antibiotic occurs during the early stages of growth, or from weaning until the pigs weigh about 100 pounds. Pigs fed antibiotics when weighing from 100 to 200 pounds show an increase of only about 5 per cent in gains. Approximately 5 milligrams of aureomycin, terramycin, or penicillin per pound of total ration should be fed pigs from weaning to

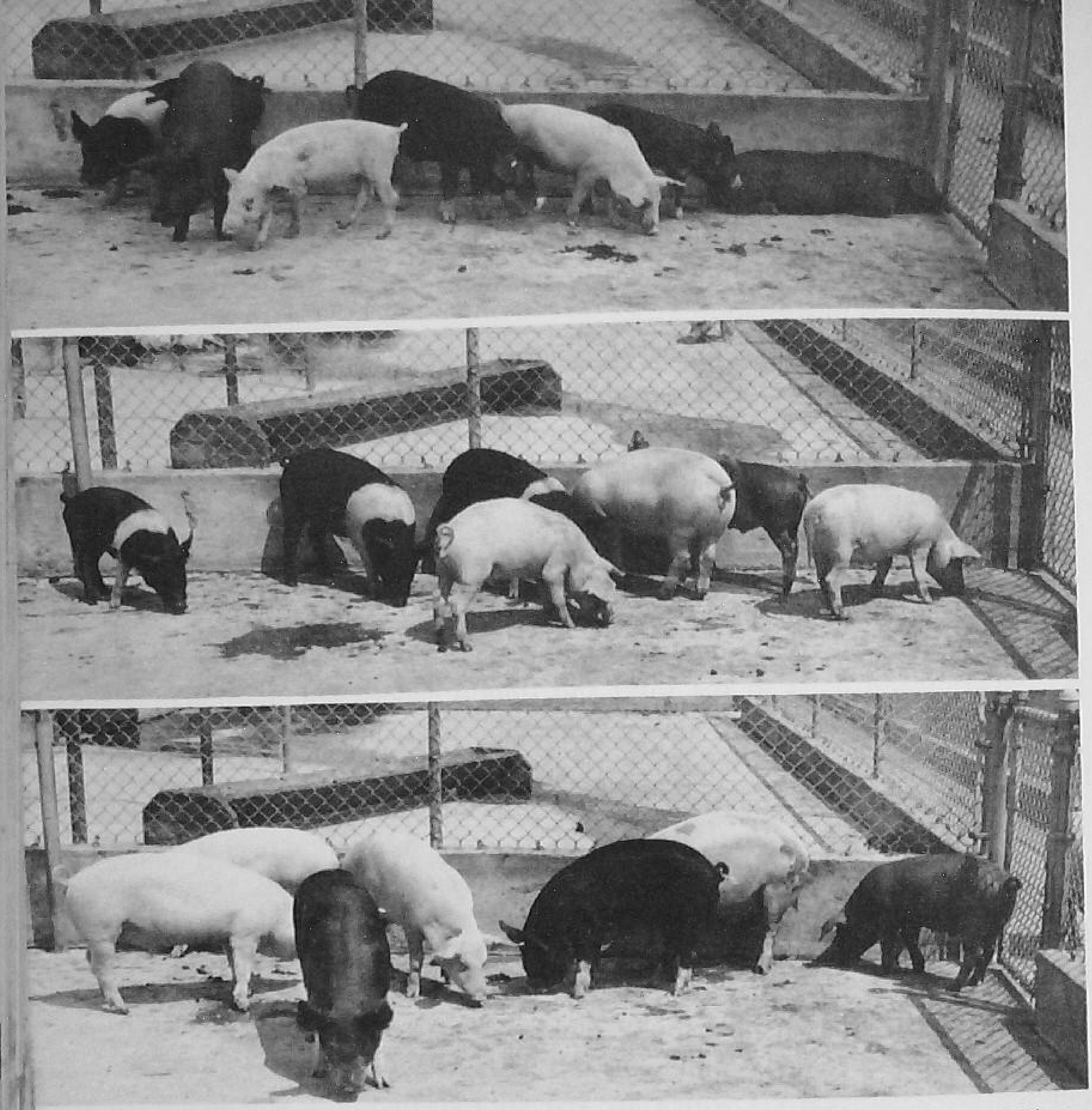


FIGURE 65. *Effect of feeding vitamin B_{12} antibiotics to pigs. (upper) Pigs received no vitamin B_{12} or antibiotics; (center) Pigs received vitamin B_{12}; and (lower) Pigs received vitamin B_{12} and aureomycin in addition to basal ration. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

market. The feeding of antibiotics during this period may be your insurance against disease, however. The feeding of antibiotics in the creep ration is recommended as a means of disease control. It reduces scouring, increases the growth rate, and improves the feeding efficiency. Pigs fed antibiotics may weigh from 5 to 20 pounds more at weaning time.

There has been some indication that the feeding of antibiotic materials to pigs throughout the growing and fattening period might increase the thickness of backfat. Tests, however, do not prove this to be true. It may be advisable to eliminate the anti-

biotics in the ration after the pigs weigh 125 pounds.

Tests conducted at Illinois and Indiana showed that the addition of a bacitracin feed supplement to furnish 5 mg. of bacitracin per pound of ration did not significantly increase the daily gains of pigs. This antibiotic implanted in the skin of young pigs at the Arkansas Experiment Station resulted in increases in weights amounting to 11.3 per cent. This antibiotic has proven quite effective when fed with penicillin. The feeding of antibiotics to healthy pigs is good insurance against scours and intestinal diseases, and some increases in gains will result. Antibiotics fed to young pigs on high-disease-level farms will produce maximum results. Tests show also that antibiotics can be effective only when fed with a balanced ration. They will not take the place of a balanced ration.

There is little evidence to date on whether or not antibiotics should be fed separately or in combination. Some vitamin-antibiotic mixes contain only one form of antibiotic. Others contain two or three.

Antibiotics may be purchased in the form of vitamin-antibiotic pre-mixes in 10-, 25-, and 50-pound packages. It is possible to add them to the other feeds included in the mixed ration. The

FIGURE 66. *Implanting an antibiotic pellet behind the ear of a pig.* (Courtesy Wallaces' Farmer and Iowa Homestead.)

amount of pre-mix needed will vary, depending on the contents of the material being used. The directions of the manufacturer, or distributor, should be followed closely, and care should be taken to mix the materials uniformly with the other feeds.

A popular and easy way to obtain feeds containing antibiotics is to buy a ready-mixed feed. Most feed companies have fortified their rations with both antibiotics and vitamins. A careful analysis of the feed tag and the price should be made to determine the best feed and the best buy.

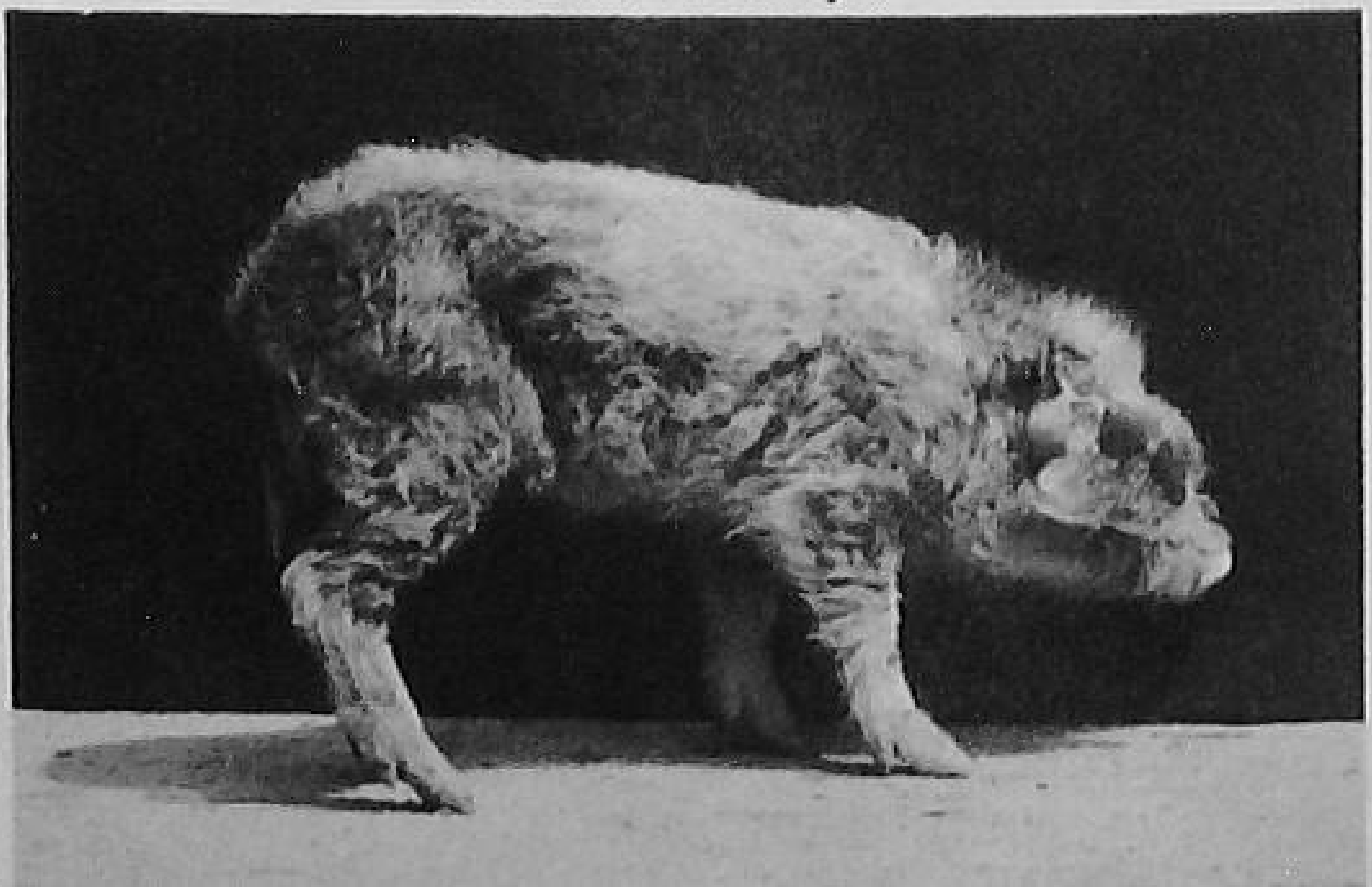
Vitamins. In cattle and sheep the bacteria and protozoa in the paunch synthesize the water-soluble vitamins in adequate amounts. These organisms do not live in the digestive systems of pigs and accordingly, feeds must be supplied in the ration which contain water-soluble vitamins. Pigs require thiamine, riboflavin, niacin, panthothenic acid, pyridoxine, biotin, folic acid, vitamin B_{12}, and choline for normal health.

In addition to the water-soluble vitamins pigs require vitamins A, D, and E, which are fat-soluble. Yellow corn and green hays and pastures supply adequate amounts of vitamin A. Sunlight provides vitamin D. Cereal grains and green hays or pastures provide vitamin E.

Some of the water-soluble vitamins are available to the pigs in farm grains and forages. Thiamine or vitamin B_1, pyridoxine, biotin, and folic acid are available in cereal grains or in forage crops, and need not be provided from other sources. The other water-soluble vitamins must be provided from sources other than the normal farm feeds.

Riboflavin should be provided at the rate of 1.4 milligrams per pound of ration for pigs weighing under 100 pounds, and .76 milli-

FIGURE 67. *A pig showing riboflavin deficiency. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



grams per pound for pigs weighing over 100 pounds. Niacin, or nicotinic acid, is required at the rate of 6 milligrams for young pigs under 100 pounds in weight, and 2.5 milligrams per pound of ration for heavier pigs.

Pantothenic acid is required by growing pigs at the rate of 3.7 milligrams per pound of ration, and choline is required at the rate of 454 milligrams per pound by young pigs. Much of the choline may be supplied by feeding corn which contains 200 milligrams per pound, and oats, wheat, and barley, which contain about 450 milligrams per pound. Meat scraps, fish meal, and soybean meal are excellent sources of this vitamin.

Vitamin B_{12} was discovered to be an important part of APF (animal protein factor), and is a by-product in the manufacture of antibiotics. About 9 micrograms (1000 micrograms equals one milligram) of vitamin B_{12} are needed per pound of dry ration for the most rapid gains of young pigs.

The best means of providing the vitamins which cannot be supplied by farm grains, protein supplements, and forages is to give them in the form of a vitamin-antibiotic pre-mix, which can be mixed with the protein supplement or with the complete ration, or to buy a ready-mixed supplement which contains the needed vitamins and antibiotics.

The information on the tag or carton should be checked carefully for the content of the mix and for the cost. The following is the information taken from a commercial pre-mix:

No. 1
VITAMIN-ANTIBIOTIC FEED SUPPLEMENT
(FOR MIXING PURPOSES ONLY)

Guaranteed Analysis

Vitamin B_{12}	5 milligrams per pound
Riboflavin	1,000 milligrams per pound
Niacin	6,000 milligrams per pound
Pantothenic acid	1,000 milligrams per pound
Choline	40,000 milligrams per pound
Aureomycin	5,000 milligrams per pound

Crude protein, not less than 10%
Crude fat, not less than 1%
Crude fiber, not less than 8%

Ingredients

Dried aureomycin meal, dried fermentation solubles and press cakes from microbiological manufacture of riboflavin and aureomycin, extracted animal liver meal, extracted soybean oilmeal, calcium pantothenate, niacin, and choline chloride.

Mineral. Pigs on good legume pasture which receive skim milk

or meat and bone meal usually need little additional mineral feeds. Pigs which are fed plant proteins on poor pasture need considerable mineral. Cereal grains are very low in mineral content, and it is a good idea to self-feed a mineral mixture or a protein supplement to which minerals have been added. Calcium, phosphorus, and salt are the most important mineral materials in feeding hogs, and they are easily obtained. Ground limestone is an excellent source of calcium, and steamed bonemeal supplies both calcium and phosphorus. A low-fluorine calcium phosphate may also be used, but an excess of .4 per cent of fluorine is toxic to the pigs.

Swine rations should contain about ½ pound of salt per 100 pounds. In tests conducted at Purdue University a penny's worth of salt saved 287 pounds of feed. Hogs without salt gained only about one-half as fast as did those which received it free choice. Salt may be fed free choice in a feeder, it may be mixed in with the mineral, or it may be mixed in with a complete ration. Usually it is mixed in with the mineral which is fed free choice.

Small quantities of so-called "trace minerals" should also be supplied in the mineral mixture. Iodine, iron, copper, zinc, manganese, and cobalt are considered most important, and they are most easily provided by purchasing trace mineral pre-mixes, or by purchasing ready-mixed mineral feeds or ready-mixed protein and mineral supplements. Recommended mineral mixtures are:

No. 1

	Pounds
Steamed bone meal	40
Ground limestone	40
Salt	20
	100

No. 2

	Pounds
Ground limestone	50
Dicalcium phosphate	30
Salt	20
	100

No. 3

	Pounds
Steamed bonemeal	38
Ground limestone	38
Salt	20
Trace mineral pre-mix	4
	100

No. 4

	Pounds
Ground limestone	600
Steamed bonemeal	900
Iodized salt	400
Trace mineral mix	100
	2000

Complete rations for growing and fattening hogs. A large percentage of hog raisers buy commercially mixed protein and mineral supplements which have been fortified with vitamins, antibiotics, and trace minerals, and either mix or feed them with home-raised grains. Some farmers prefer to mix a complete ration of their own. Shown in Table 11 are recommended rations.

TABLE 11

Complete Rations for Growing and Fattening Hogs *

Weight of pig	Weaning to 75 lbs.		75 lbs. to 150 lbs.		150 lbs to market	
Feed lot condition	Pasture	Drylot	Pasture	Drylot	Pasture	Drylot
Ration	F	G	H	I	J	K (Self-feed Mineral Mix)
Ground yellow corn.....	1300	1100	1400	1200	1600	1400
Ground oats	300	400	300	400	200	300
Supplement (Ingredients listed below)	400 (No. 1)	500 (No. 1)	300 (No. 3)	400 (No. 2)	200 (No. 3)	300 (No. 2)
Pounds	2000	2000	2000	2000	2000	2000
(Calculated analysis)						
Protein, %	14.3	15.9	13.0	14.2	11.3	12.7
Fat, %	3.6	3.5	3.5	3.5	3.6	3.6
Fiber, %	4.6	5.4	4.0	5.1	3.4	4.3
Calcium, %	0.8	1.0	0.6	0.9	0.4	0.6
Phosphorus, %	0.5	0.6	0.4	0.5	0.4	0.4
Vit. A, Units/lb.	2800	2975	1775	2700	1850	2525
Vit. D_2, Units/lb.	400	500	225	300	150	225
Vit. B_{12}, mcg./lb.	6.0	7.5	3.0	4.0	2.0	3.0
Riboflavin, mg./lb.	2.0	2.3	1.2	1.8	1.0	1.4
Niacin, mg./lb.	16.0	17.8	12.4	14.8	11.1	13.2
Pantothenic acid, mg./lb..	4.8	5.5	3.9	4.8	3.3	4.1
Choline chloride, mg./lb..	422	480	381	430	320	372
Antibiotic (s), mg./lb. ...	6.0	7.5	3.0	4.0	2.0	3.0

BALANCED SUPPLEMENTS FOR SWINE

Formula No.	1	2	3
Stage of Production	For bred sows, sows & litters, and young pigs up to 75 lbs.	For hogs from 75 lbs. to market — Drylot	For hogs from 75 lbs. to market — Pasture
(Ingredients)	(Pounds unless otherwise indicated)		
60% Tankage	300	200	100
44% Soybean oilmeal	950	1050	1350
41% Cottonseed meal	100	100	100
34% Linseed meal	100	100	100
17% Dehydrated alfalfa meal	300	300	100
Vitamin D_2	4 million units	3 million units	3 million units
Vitamin B_{12}	60 milligrams	40 milligrams	40 milligrams
Riboflavin	12 grams	10 grams	8 grams
Niacin	70 grams	60 grams	50 grams
Calcium pantothenate.	12 grams	10 grams	8 grams
Choline chloride	450 grams	400 grams	300 grams
Antibiotic (s)	60 grams	40 grams	40 grams
Ground limestone	60	100	110
Steamed bonemeal (or equivalent)	110	100	100
Salt	40	40	40
Trace mineral mix...	15	10	5
Total Pounds	1975	2000	2005

* Damon Catron and others, *Balanced Swine Ration Formulas*, Revision No. 6, Iowa State College, 1951.

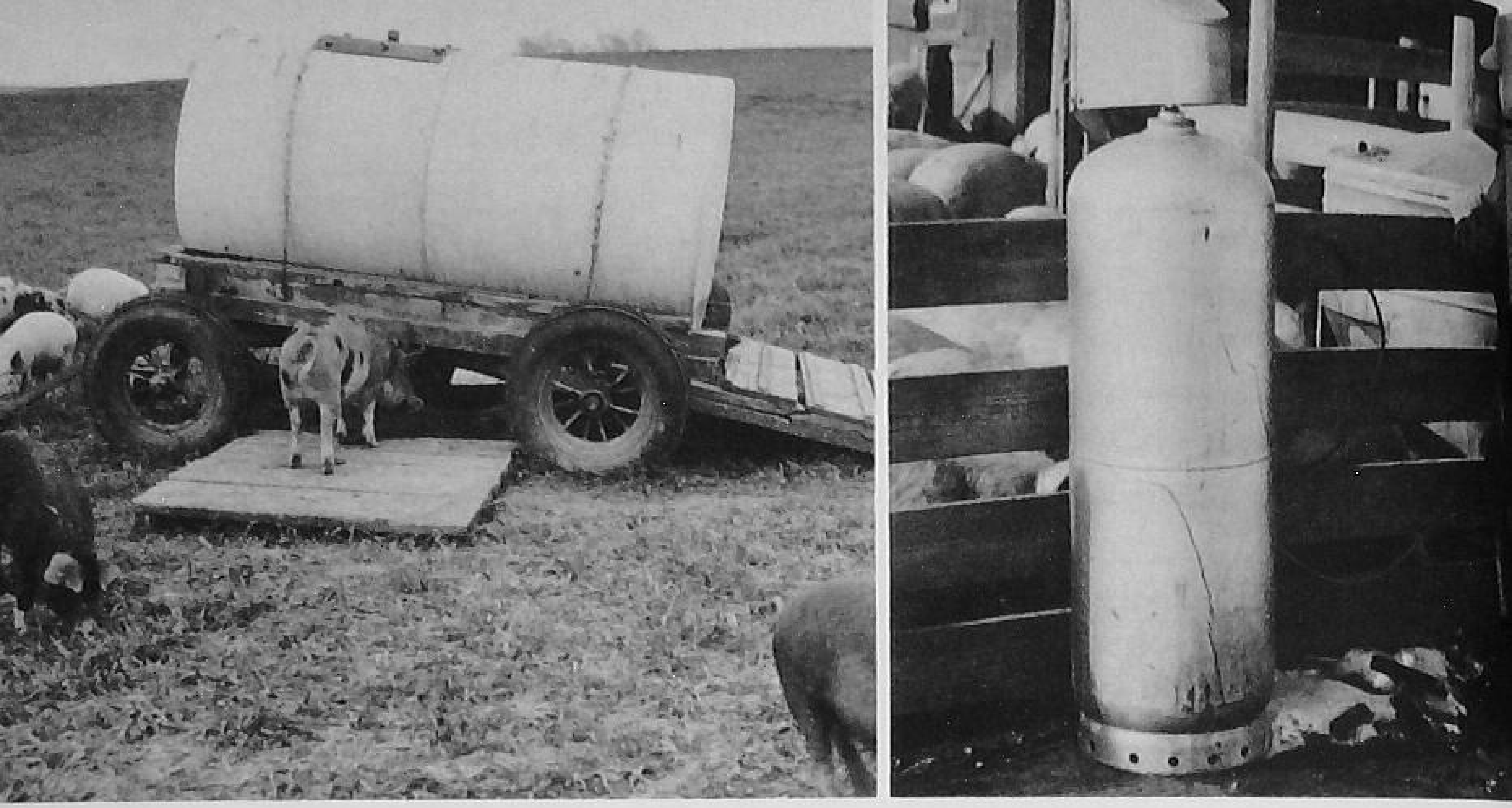


FIGURE 68. *(left) A portable waterer for hogs on pasture. (right) A bottle gas burner keeps the water from freezing during winter. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

Water. If you want your pigs to make fast and economical gains, they must have plenty of fresh water available at all times. A pig needs from ½ gallon to 1½ gallons of water daily for each 100 pounds of live weight. Eighty pigs weighing 150 pounds on pasture in July may consume as much as 80 to 150 gallons of water in one day. Young pigs and sows nursing litters have high water requirements, and more water is needed during the hot months of the summer than during the winter.

Although water may be supplied in the form of skim milk or buttermilk, and slop feeds, it is preferable that the pigs have access to automatic waterers. Hand-feeding of water in clean troughs is satisfactory if done often enough, and if the pigs can be kept out of the troughs. Slats may be nailed across the trough to accomplish this purpose. The labor necessary to provide a sufficient amount of water by hand is usually not available.

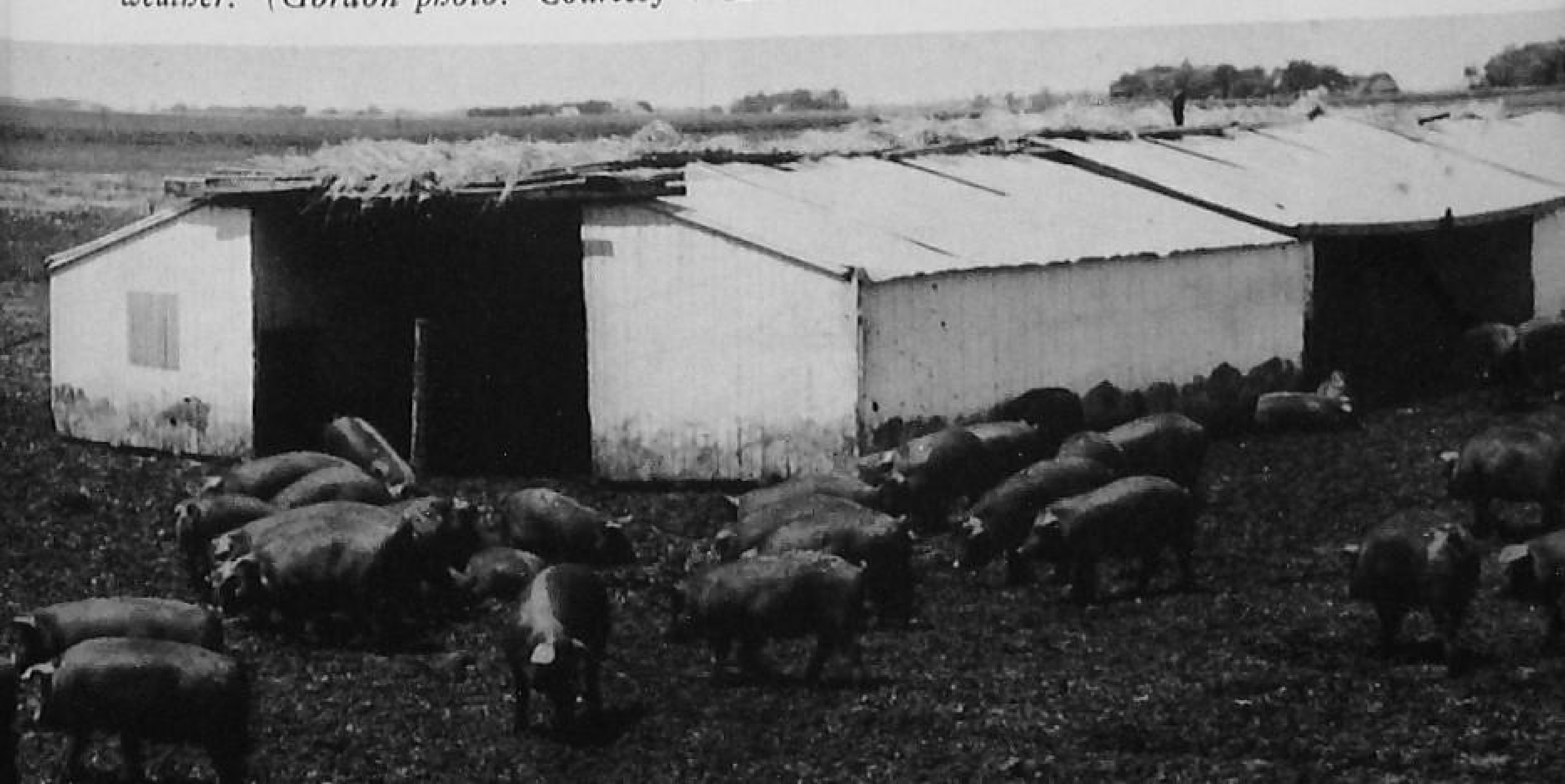
Recent tests at Iowa State College indicated that pigs which were supplied heated water in automatic waterers from December 12 to January 23 gained approximately 10 pounds more than did pigs which were hand-watered. The slower gains were attributed to the fact that the hand-fed water froze, and was not available to the pigs. The heating of the water did not affect the quantity of feed required to produce a pound of gain. The use of waterers with heating units is recommended during the cold winter months in areas where freezing temperatures prevail.

FIGURE 69. *A portable sun shade. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

Shade. The use of rotated pastures during the summer months makes it necessary to provide some form of shade to protect the pigs from the hot sun. Pigs in wooded areas or those which have access to the farm buildings usually need no other shade unless the pasture area is at some distance from the buildings.

The shades should be from 4 to 5 feet above the ground to permit circulation of air and should be located on high ground. A 10 x 12 foot shade will accommodate ten to twenty pigs, depending upon their size. The sunshades may be temporary structures or they may be pieces of equipment which can be moved from field to field.

FIGURE 70. *Straw roof between two individual houses provides shade during hot weather. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



Hog wallows. Sanitary wallows may be used during the summer months to aid in keeping the pigs cool and in maintaining health. Portable wallows of the type shown in Figure 71 or permanent wallows of the type shown in Figure 72 may be con-

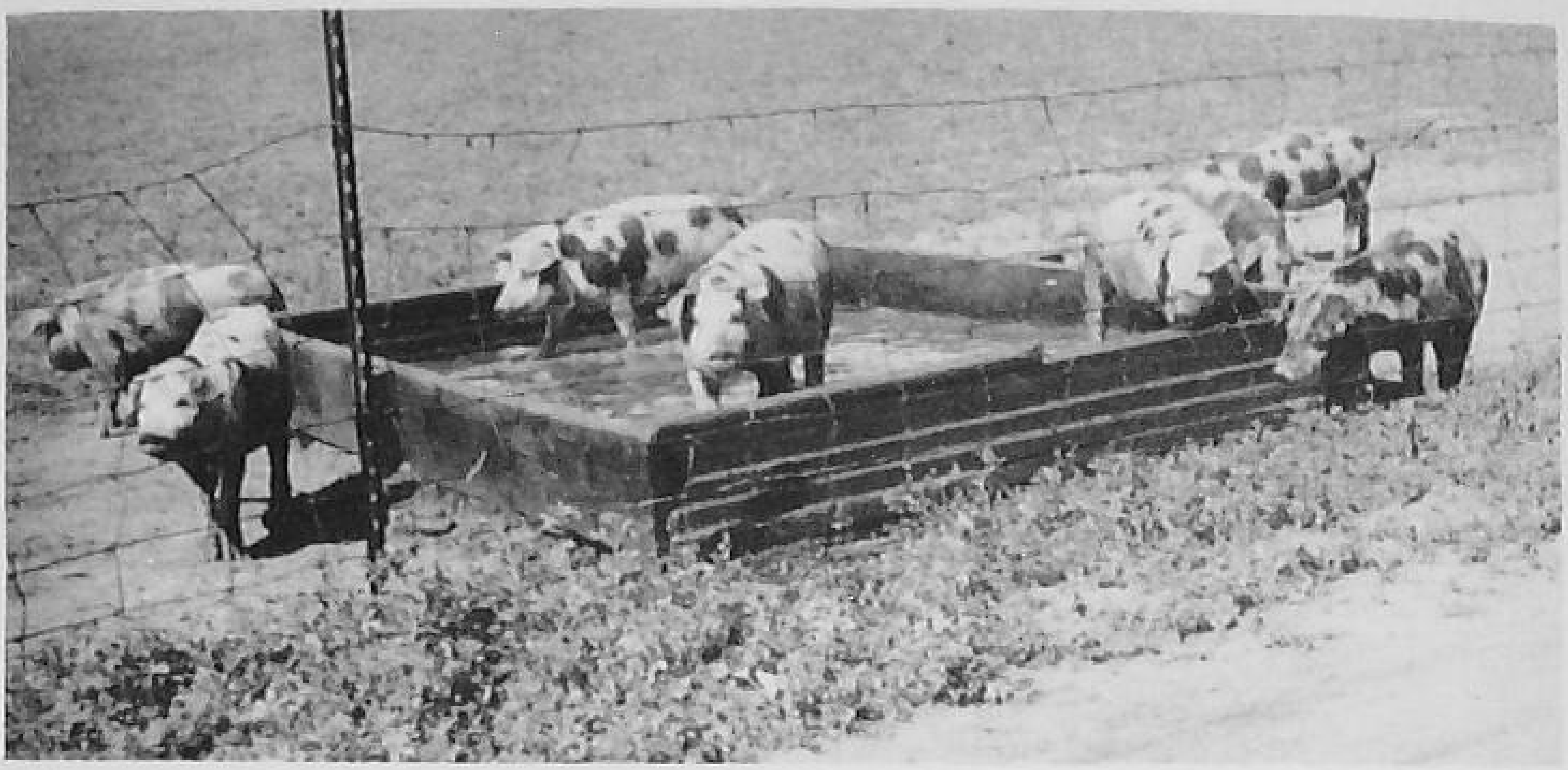
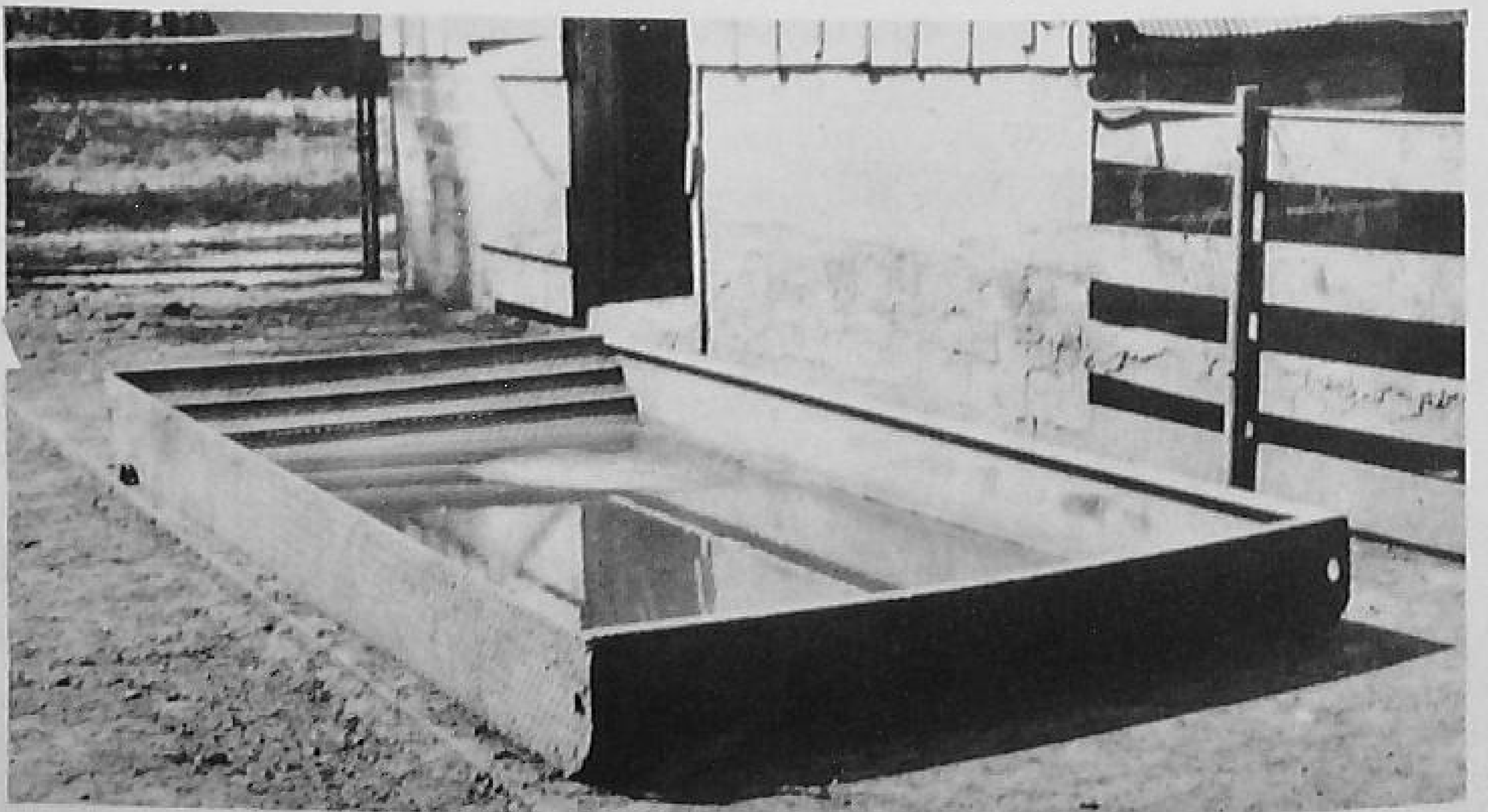


FIGURE 71. *A portable pig wallow. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

structed. The concrete wallow, however, does not fit in very well with the use of rotated pastures. A good permanent wallow has a sloping floor, and is from 12 to 18 inches deep. The portable wallow is more adaptable to the needs on farms where rotated pastures are used.

Feeding and Management of Pigs on Dry Lot. Tests conducted at the Ohio Agricultural Experiment Station indicated that pigs

FIGURE 72. *Hog wallow made of steel. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



can be finished more cheaply and more quickly on pasture than can pigs on dry lot. Other tests show that pasture-finished pigs may produce firmer and better muscled carcasses. A few years ago it was a common practice to bring the pigs in from the pasture and feed them heavily on corn and supplement to finish them for market. A large percentage of the spring pigs produced today are moved directly from the pastures to the markets. The dry lot gains were largely gains in lard. Lard is cheap at the present time, and it does not pay to put that kind of a finish on our hogs.

Summer and fall pigs. Pigs farrowed in the summer or fall usually are finished in the Corn Belt states on dry lot. In some southern areas it is possible to have pastures available during the winter months by rotation of crops. Where pastures are not available, it is necessary to make changes in the ration and in the management program to supply the vitamins, proteins, minerals, and sanitation normally provided by the pastures.

Most summer and fall pigs are well beyond the weaning stage by the time the pastures dry up in the fall. The pigs will weigh from 75 pounds upward, and can be fed the rations recommended for dry-lot feeding in Table 11. Dry-lot rations contain less corn, more oats, and more supplement than do pasture rations. The supplement recommended for dry-lot feeding contains more animal protein, more alfalfa, more vitamin supplements, and less soybean oilmeal than that recommended for pasture feeding.

The use of self-feeders and automatic waterers is recommended in dry-lot feeding as in pasture feeding. The big problems in dry-lot feeding, aside from nutritional problems, have to do with providing adequate and sanitary quarters. It is much more difficult to care for a large number of pigs in a hog house, on a feeding floor, or in a small lot than it is to manage pigs on pasture. Bedding, ventilation, and sanitation problems are often troublesome.

Feeding floors. A paved feeding floor is the answer to many of the sanitation problems in dry-lot feeding. Concrete feeding floors can be cleaned quite easily, and the pigs do not have to use their energy in wading through mud during the wet fall and spring seasons. Considerable labor and feed are saved in feeding and in managing hogs on feeding floors. More of the fertilizer value of the manure is saved, and more sanitary conditions can be maintained. A good feeding floor is almost a "must" in dry-lot feeding, especially during the wet weather.

FIGURE 73. *A well-planned hog house and feeding floor.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

Usually it is best to locate the feeding floor next to the hog house and granary or next to the corn crib. Approximately 10 to 12 square feet of floor space should be provided per hog. A floor 15 x 40 feet will accommodate from 50 to 60 hogs weighing from 150 to 200 pounds.

The feeding floor should be from 4 to 6 inches thick, depending upon whether heavy loads will be driven over it. There should be a slope of 1/4 inch per foot for drainage, and the surface should be finished with a wood float. This will produce an even, uniform, nonskid surface.

A concrete mix of 1 part cement to 2 1/4 parts sand and 3 parts gravel is recommended for use in building feeding floors. Not more than 5 gallons of water should be used per sack of cement if the sand is moist, and no rock or gravel more than 1 1/2 inches in diameter should go into the mix.

Hogging Down Corn. The practice of hogging down corn is less popular today than it was a few years ago. With the two-litter system of breeding, the spring pigs are farrowed in February and March and are marketed before the new crop of corn is ready for hogging down. The fall pig crop may be large enough to

FIGURE 74. *Hogging down corn. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

glean a field following the corn picker, but the pigs are usually too small to break down the stalks in the hogging-down process.

In hogging down corn, best results are obtained by using thin, active pigs weighing from 90 to 150 pounds. Heavier hogs waste more corn and do not make economical gains.

An early maturing variety of corn is best for hogging down, and the pigs should be turned in after the corn is well dented. A protein-mineral supplement and water should be available at all times.

Garbage Feeding. Many cities have passed ordinances prohibiting the feeding of raw garbage to hogs, but much garbage is fed around cities where it is permitted. The cooking of garbage kills disease organisms, but it is costly and the cooked garbage is less palatable to the pigs.

A ton of raw garbage used to produce from 50 to 80 pounds of pork. With the changes that have come about in kitchen and restaurant management, a ton of raw garbage today will produce only from 20 to 30 pounds of pork. Unless considerable grains are fed with the garbage, a poor carcass will be produced.

Garbage-fed hogs have been responsible for the rapid spread of vesicular exanthema during the past few years, and many cases of trichinosis have been prevalent in some communities where raw garbage is fed to hogs. In feeding garbage extreme care should be taken to maintain sanitary quarters. Concrete feeding floors are recommended, and the yards should be thoroughly cleaned and disinfected regularly. Thorough cooking of pork products is necessary to kill any disease organisms which may be prevalent in the meat.

SUMMARY

A hog raiser must use proven methods if he is to have a profitable enterprise. The sows must be properly fed and cared for at farrowing time. Farrowing stalls, heat lamps, and guard rails will save many pigs. The feeding of synthetic milk will permit the taking of pigs from the sow at an early age and will save many pigs from large litters whose mothers are poor milkers. The feeding of a good pig starter, which is fortified with antibiotics, vitamins, protein, and sugar, will supplement the sow's milk. Pigs will begin to eat when just a few days old.

Cracked corn and rolled oats are excellent feeds for young pigs.

Pig starters should contain from 16 to 20 per cent protein, 3 to 4 per cent fat, not more than 3.5 per cent fiber, one per cent calcium, .6 to .8 per cent phosphorus and .5 per cent salt. The sugar content should be from 5 to 15 per cent; if the starter is fortified with vitamins and antibiotics, from 20 to 40 grams of antibiotics should go into each ton of pig starter.

Aureomycin, terramycin, and penicillin are about equal in value in increasing the rate of gain and the efficiency of feed utilization. Antibiotics are of most value when fed to young pigs and to pigs which are in poor health.

Pigs should be vaccinated for erysipelas at four to seven days of age and for cholera when four to six weeks of age, when the double treatment is to be used. They should be castrated about ten days after vaccination and weaned at about eight weeks of age.

Pigs should be wormed about two weeks after weaning. Sodium fluoride is recommended.

The use of a good legume pasture can save from 10 to 20 per cent of the grains and concentrates and will produce better carcasses. Ladino clover, alfalfa, red clover, lespedeza, and birdsfoot trefoil are our best pastures. An acre will graze from fifteen to twenty hogs.

Self-feeding pigs on pasture is recommended; however, hand-fed wet mash rations may produce more rapid gains. Corn, wheat, oats, barley, and grain sorghums should make up the main part of the ration. A good protein and mineral supplement which contains vitamin B_{12} should be self-fed.

A healthy pig should produce 100 pounds of gain on from 300 to 375 pounds of grains and concentrates. Pigs weighing from 75 to 150 pounds require 12 per cent protein rations, and pigs weighing over 150 pounds require 10 per cent protein rations.

The best way to provide vitamins, antibiotics, and trace minerals is to buy a pre-mix, which can be mixed with home-grown feeds and protein supplements, or to buy a commercially mixed supplement which contains these materials.

A mixture of steamed bone meal (38 pounds), limestone (38 pounds), salt (20 pounds), and trace mineral pre-mix (4 pounds) will meet the mineral needs of growing and fattening hogs.

Shade must be provided during hot weather, and water must be available at all times. Hog wallows also will add to the comfort of the pigs.

QUESTIONS

1. Outline the plan which you should use on your home farm in caring for your brood sows at farrowing time.
2. Which method is best in saving newborn pigs: using guard rails, using pig brooders, using heat lamps, or using farrowing stalls? Why?
3. What attention should be given pigs at farrowing time?
4. What system will you use in marking your pigs at farrowing time?
5. How can you control anemia in young pigs?
6. How can synthetic milk be used effectively on your farm?
7. What are the essentials of a good pig starter?
8. Outline a sanitation program adapted to the hog enterprise on your farm.
9. What percentage of protein should rations contain for pigs weighing from 75 to 150 lbs.?
10. Which amino acids are needed by growing and fattening pigs?
11. What is the place of the vitamins in the ration?
12. Which antibiotics should be fed to young pigs and in what amounts?
13. Does it pay to self-feed pigs on pasture?
14. Outline a good simple mineral mixture.
15. What are trace minerals, and how may they be supplied?
16. Which makes the best hog pasture, ladino clover, red clover, or brome grass? Why?
17. How much feed should be used in producing 100 pounds of gain with pigs on alfalfa pasture?

REFERENCES

Anderson, Arthur L., *Swine Management*, J. B. Lippincott Company, Philadelphia, 1950.

Beaty, Harold H., and Van Vlack, C. H., *Paved Floors and Lots for Iowa Farms*, Bulletin P 70, Iowa State College, 1950.

Becker, D. E., *Practical Results of Antibiotic Research*, 1952 Illinois Farm and Home Week.

Bohstedt, G., *Antibiotics and Vitamin B_{12} in Livestock Feeding*, University of Wisconsin, Circular 392, 1951.

Brinegar, Merle J., and Warner, Donald R., *Nutrients, Feeds and Example Rations for Swine*, University of Nebraska, Circular 253, 1951.

Ensminger, M. E., *Swine Husbandry*, The Interstate Printers and Publishers, Danville, Illinois, 1952.

Smith, W. W., *Pork Production*, The Macmillan Company, New York, 1952.

< 9 >

Control of Diseases and Parasites

Swine diseases and parasites are responsible for losses amounting to millions of dollars each year. It is estimated that one-third of the pigs farrowed die before they are weaned, and another one-third are stunted or are unprofitable because of diseases or parasitic conditions. Only about one-third of the pigs farrowed are grown out as healthy pigs. On many farms the profit or loss from the enterprise is determined largely by the extent to which disease and parasite losses have been controlled.

PREVENTION IS BETTER THAN A CURE

Most diseases, ailments, and parasitic conditions of hogs may be prevented, and preventative measures are much more effective than are cures. The treating of diseased pigs is expensive because of medicine and veterinarian costs and because feeds are wasted when fed to unthrifty pigs. A stunted or runty pig requires a long feed-

FIGURE 75. *Hogs in advanced stages of hog cholera. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

ing period and a large amount of feed to get him ready for market. It is cheaper to prevent the unhealthy condition than it is to remedy it. Proper treatments and remedies are of some value, and must be used after the disease or parasitic condition is present.

Farmers who raise large numbers of hogs year after year, on the same lot, usually have disease and parasite losses. The disease germs and worm eggs live through the winter in the filthy lots and unsanitary houses. Each new crop of pigs is infected or infested. The control of diseases and parasites is largely a matter of sanitation. The use of disease- and parasite-free breeding stock, rotated legume pastures, clean and disinfected houses, and good balanced rations, fortified with vitamins and antibiotics, can do much to reduce losses. Some diseases and parasites, however, must be controlled by vaccination and medication.

SWINE DISEASES

There are a large number of infectious diseases of swine and their prevalence varies from community to community, and from year to year. Cholera, erysipelas, necrotic enteritis, black scours, atrophic rhinitis, brucellosis, flu, vesicular exanthema, anemia, baby-pig disease, and gastroenteritis produce most of our disease problems.

Hog Cholera. Losses in the United States due to hog cholera vary from \$10 million to \$60 million annually, and these losses occur even though biological products have been developed and are effective in preventing the disease. Cholera is one of our most serious diseases.

Cause. The disease is caused by a small virus which cannot be seen under a microscope. It is present in the blood and body tissues of an infected animal, and is spread through the urine and feces, as well as through nose and mouth secretions. Contaminated feed and water cause the infection, which spreads through the hog's body by way of the digestive system.

Young hogs are more susceptible to the disease than are older hogs, and the virus is usually introduced by bringing new animals to the herd, or by the carrying of virus to the farm on the shoes of attendants. It can be spread also by trucks, by birds, and by streams.

Symptoms. The incubation period, or length of time between exposure and the first symptoms of the disease, is usually from

three to seven days. Infected animals first show fever and a loss of appetite. Later the eyes become filled with a sticky discharge, and the hogs prefer dark quarters. They lose weight, and the underside of the neck and abdomen may show dark red or purple coloration. Infected animals cough and have difficulty breathing.

Usually the first cases which appear are in acute form, and the animals die in from three to seven days. Chronic cases last longer. Some hogs do not die but make only partial recoveries.

Treatment and prevention. There is no drug treatment for the disease, but some benefit may result if large doses of anti-hog-cholera serum are given the hogs in the early stages. Hogs which are protected from becoming infected with the disease may be raised without vaccination. However, it is almost impossible to protect the hogs, so vaccination is recommended.

Pigs may be vaccinated at any age, but the cost increases with the increased weight of the pig. As pointed out previously, pigs should be vaccinated when they are from four to six weeks old, when the double treatment is used. The double treatment involves the injection of anti-hog-cholera serum and the virus into different parts of the body. This usually produces immunity for life. Pigs given the double treatment should be fed lightly for several weeks following vaccination.

Some veterinarians use hog cholera vaccines instead of the serum and virus. No live virus is introduced into the herd under this system. Crystal violet and tissue vaccines are available. They, however, are not effective for about three weeks after injection, and the immunity lasts only from six to eight months. If these vaccines are used, it is necessary to revaccinate breeding stock after six to eight months.

A number of new rabbit-adapted hog cholera virus vaccines have been developed which show much promise. Some producers of these vaccines recommend that anti-hog-cholera serum be injected with the new rabbit-type virus vaccines. Others recommend that it be given alone. Some of these new vaccines can be given to pigs from six to seven weeks of age. In using these products, follow closely the recommendations of the manufacturer. In most cases a veterinarian should be called in to vaccinate the pigs.

Erysipelas. This disease is prevalent in the Midwest and is especially serious in some areas. Hogs may contract the disease in the

acute form and die quickly, or they may have the chronic form, which causes swelling of the joints in the legs and general stiffness. It is sometimes called the "diamond-skin" disease.

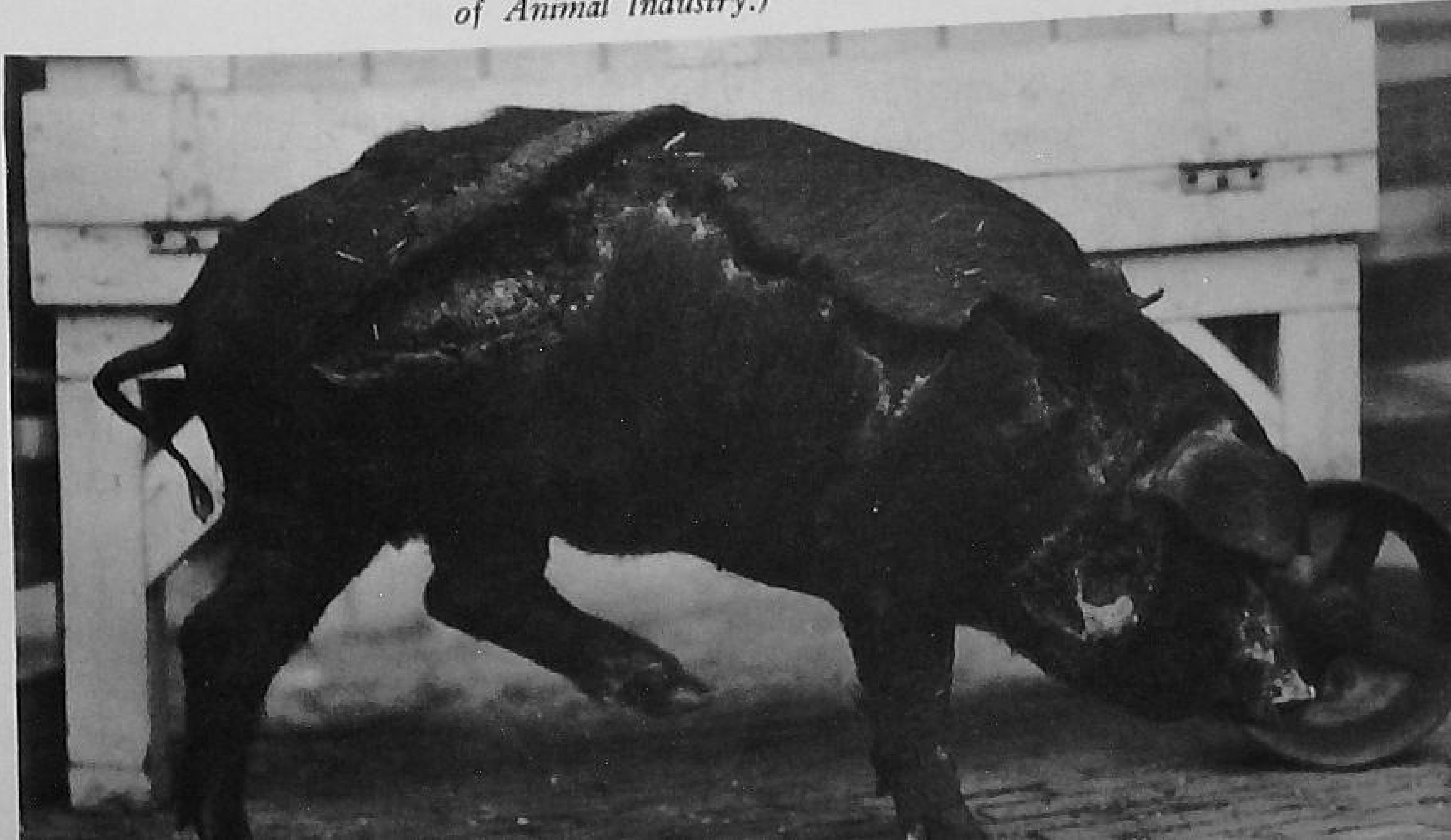
Cause. The disease is produced by a microorganism or bacteria similar to those which cause arthritis in some animals. Diseased animals, and others which carry the disease, pass off the organism in urine and feces, and other hogs pick it up by eating contaminated feed or water.

Symptoms. Erysipelas presents itself in many forms and is difficult to diagnose. Hogs with the acute form have a high body temperature and may have a redness of skin as in cholera. They may die within 24 hours to 3 or 4 days. Those with the less acute form run high temperatures for a couple of days; when the temperature drops red diamond-shaped patches, which disappear in time, show on the skin. Mortality from this form is low.

Those that have the chronic form are stiff in the joints and lame. They become sluggish and are easily fatigued. Often they rest on their haunches or on their breastbones.

Treatment and prevention. No medicines have been effective in treating erysipelas, but the injection of anti-erysipelas serum in the early stages of the disease is helpful. Exceptionally good results have been obtained when penicillin was injected with the serum in both the acute and chronic forms of erysipelas. In some cases repeat injections are necessary. Since the disease is difficult

FIGURE 76. *An animal infected with swine erysipelas.* (Courtesy U.S.D.A. Bureau of Animal Industry.)



to identify, it is best to rely upon the local veterinarian for diagnosis and treatment.

Sick animals should be segregated from the herd immediately, and the healthy animals moved to clean ground. As a preventative, the entire herd may be vaccinated with the serum and penicillin.

The microorganism continues to live in old lots and houses. Rotated pastures and a clean-up of houses and equipment are essential.

The best means of preventing the disease is to double-treat the pigs at five to seven days of age with live-culture erysipelas vaccine and anti-swine-erysipelas serum. When bringing new animals to the herd, insist that they come from disease-free herds or from herds which, as pigs, were double-treated for erysipelas.

Necrotic Enteritis or Necro. This disease is often associated with other diseases and with wormy pigs. It is the cause of large losses of pigs each year, as well as the cause of a large number of runt pigs. It produces an inflammation of the intestines. It is very infectious, easily spread, and chronic. It continues for a long period of time.

Cause. The disease is caused by a microorganism which is highly virulent in the presence of hog cholera. Often so-called "hog cholera breaks" are caused in part by necrotic infections.

Symptoms. Necro usually begins with a rise in temperature, a decrease in appetite, and diarrhea. The temperature drops after a few days, and the pigs begin to eat again. They remain unthrifty, however, and fail to gain normally. They are usually weak, remain thin, and have rough hair coats.

Treatment and prevention. No satisfactory medical treatments that can be recommended generally have been developed. A number of commercial products are helpful, and the feeding of milk products and low-fiber content rations is recommended.

The feeding of antibiotics to pigs weighing under 75 to 100 pounds appears to aid materially in controlling necro. The feeding of pig starters and milk recommended in an earlier chapter will also aid in controlling the disease. Forty to 80 milligrams of aureomycin, terramycin, or penicillin per pound of total ration is recommended in feeding young pigs which are infected with necro.

Sanitation is important in controlling necrotic infections. Rotated pastures, sanitary quarters, and the isolation of any sick pigs will help prevent losses.

Wormy pigs often become infected with necro because of their poor health; worming pigs will aid in preventing necro infection.

Black Scours. This disease is sometimes called "bloody scours" or "swine dysentery," and may be confused with necrotic enteritis and with trichinosis. It is almost always associated with unsanitary conditions.

Cause. The cause is unknown, but it is recognized as a specific disease. Healthy pigs fed feeds contaminated with materials from the intestines of diseased animals become infected.

Symptoms. This disease is very acute and infectious, and the main symptom is a bloody diarrhea or black feces. The animals may or may not go off feed. They have some fever, but it is not high. Some pigs die within a few days, others linger for several weeks or longer. It is more serious in young pigs than in older pigs. Fifty per cent or more of the young pigs in an infected herd may die. The disease affects the caecum and the colon, which becomes inflamed and bloody.

Treatment and prevention. Many remedies have been used in the control of black scours, and some with favorable results. Prompt treatment of infected pigs with sulfamethazine is quite effective. One to two grains per pound of body weight has been recommended as the initial dose. This should be followed with about half this amount each twenty-four hours for two or three days.

The isolation of sick animals and the moving of healthy pigs to clean ground is recommended, as in the control of necro.

The contaminated quarters should be cleaned and the lots cultivated, if possible. Avoid bringing to the farm pigs which have come from infected herds, been transported in infected trucks, or passed through sales barns or stockyards.

Atrophic Rhinitis. This disease has been prevalent for at least the past ten years, but has caused most losses since 1950. It is now widespread among herds of both purebred and commercial hogs. It is quite often confused with *bull nose*. Rhinitis is very infectious, whereas bull nose is not contagious.

Cause. The disease is caused by infectious organisms which get into wounds or scratches in the mouth or nose of the pig. It spreads from one pig to another through contaminated feed or water or by body contact. Recent studies indicate that parasites of the trichomonad family may cause atrophic rhinitis. In tests

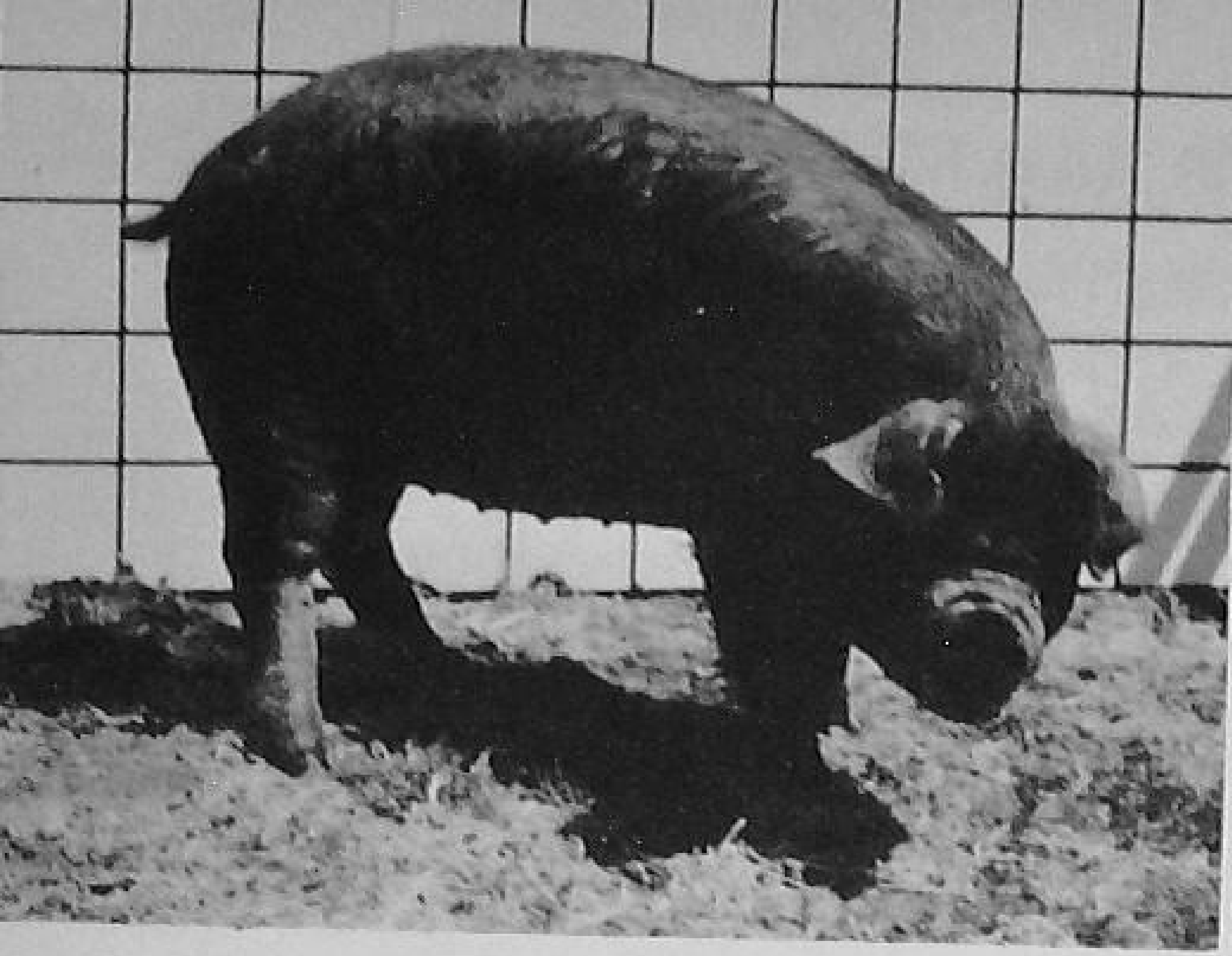


FIGURE 77. *(left and right) Pigs with twisted and distorted snouts due to atrophic rhinitis. (Courtesy M & M Livestock Products Co.)*

conducted at Iowa State College 80 per cent of the infected pigs had trichomonads in the snout, whereas only 2.8 per cent of those not affected had them. These findings may provide a clue to the control of this infection.

Symptoms. The infection seems to start when the pigs are a few days or a few weeks old. They first show signs of sneezing, which becomes more pronounced as they grow older. At from four to ten weeks of age the skin on the snout begins to wrinkle, and the snout may bulge or thicken. Sometimes the snout becomes twisted or distorted. This is usually not noticed until the pig is from three to four months of age. Some pigs recover and show no outward signs of the infection. However, they may be carriers.

The hair coat is usually rough, and infected pigs are poor doers. Quite often there is a discharge from the nose which may be clear and thick or pus-like and bloody. Some pigs develop a short, deformed snout similar to that of the early Berkshires.

Treatment and prevention. Some breeders and veterinarians are now treating young pigs for atrophic rhinitis by inserting drops of antibiotics in the nose. Check with your veterinarian in regard to the treatment. The feeding of antibiotics in the pig starter at the level recommended will aid in preventing infection. Care should be taken in clipping needle teeth to avoid injury to the mouth or gums. Such injury may provide a place for infection. Ringing of pigs should be avoided for the same reason; if they are rung, injury to the bone structure should be avoided.

Other means of control seem to involve (1) isolating and selling diseased animals, (2) bringing only disease-free animals on to the farm and keeping them isolated for several weeks, (3) practic-

ing sanitation in housing and feeding, (4) growing hogs on clean ground, and (5) if possible, dividing the pig crop into lots which are fed and managed separately. There is some evidence that rations high in vitamins will help to control rhinitis.

Brucellosis. This disease has been known as *contagious abortion of swine* and as *Bang's disease*. Surveys indicate that one to 3 per cent of the hogs in the United States are infected, and each year many persons become infected with brucellosis from cattle and hogs, or from dairy and pork products. In man the disease is known also as *undulant fever* and as *Malta fever*.

Losses caused by brucellosis in swine herds are due to the abortion of pigs, pigs born weak, sterility or infertility in sows and gilts, and sterility in the boar when the reproductive tract becomes infected.

Cause. The disease is caused by an infectious organism, *Brucella suis*, and is spread from animal to animal through contact, and by contaminated feed, water, and after-birth.

Symptoms. There are no symptoms which can be easily recognized with certainty. Many animals carry the disease but appear to be normal in every respect. Symptoms which may appear are premature abortion of litters, sterility, and inflammation of the uterus or womb, testicles, and joints. Small litters may also be a symptom, but they often result from other causes.

The only sure way to determine whether or not your herd is infected is to have the entire herd blood-tested. A herd of swine may be considered free from infection when, on two tests made from thirty to sixty days apart, no animal reacts, no previous evidence of infection (such as abortion and weak pigs) exists, and no new stock has been added to the herd during the past three months.

Treatment and prevention. There is no treatment. The herd should be tested and all reactors marketed. A re-test should be made within thirty to ninety days and all infected animals sold. The operation should be repeated until the herd is free from the disease. In some states herds are declared brucellosis-free after two tests, given at least thirty days apart, are negative.

Breeding and feeding stock should be selected from brucellosis-free herds, and all animals brought on to the farm should be isolated for at least two weeks. Raising pigs on clean ground and dividing the herd into lots which are fed and managed separately are good practices.

Vesicular Exanthema. This disease is fairly new to the Corn Belt but has been known for about twenty years in California. In June, 1952, a load of raw garbage containing uncooked pork chops was carried out of California on the diner of a train and set off at Cheyenne, Wyoming. A hog raiser at Cheyenne fed the raw garbage to pigs which were later shipped to a hog-cholera serum firm in Nebraska. Those Wyoming pigs apparently became infected with V.E. (vesicular exanthema) from the garbage and carried it to Nebraska. From the serum firm it was carried to the Omaha stockyards. By the close of 1952 it had shown up in thirty-six states.

Cause. Vesicular exanthema, like foot and mouth disease, is caused by a sub-microscopic germ of the virus group. It is extremely contagious and spreads rapidly from animal to animal. It also may be spread by contaminated carriers or objects.

Symptoms. The chief symptom of V.E. disease is the formation of blisters on the lips, tongue, snout, and above and between the claws of the feet. There is usually a rise in body temperature and a loss of appetite. The blisters often break and ulcers form. Pigs may show lameness and they may lose their hoofs. The mortality rate is high in young pigs, but the disease is seldom fatal in older hogs.

Treatment and prevention. There is no known vaccination for V.E. disease, and in most states infected animals are quarantined and later slaughtered. No treatment is available. Since the disease may be spread through raw garbage, many states have passed laws to prohibit the feeding of raw garbage. By early 1953 five states had such laws, twenty-three states had legislation in progress, and an additional thirteen states were getting ready to start such legislation.

Care in buying breeding and feeding stock, isolation of new animals brought onto the farm and immediate isolation of sick animals, and sanitation in transporting, housing, and feeding hogs, recommended for other swine diseases, should be practiced to prevent losses due to vesicular exanthema. A veterinarian should be called immediately if symptoms show up.

Flu. In a survey made in one state 16 per cent of the farmers interviewed said that their hogs had had flu during the past year. Very few animals die with the flu, but it can take the profit out of the hog business.

Cause. Flu in hogs, much like flu in humans, is caused by a virus. It is passed readily from one animal to another. It is most likely to show up when the resistance of hogs has been lowered by fatigue, exposure to temperature changes, changes in feeds, or movement to new quarters. Hogs confined in a poorly ventilated building may become overheated and may chill when exposed to the air. Drafty and extremely cold sleeping quarters can cause just as much trouble as buildings which are too hot.

Symptoms. Infected pigs usually go off feed and become listless and inactive. They appear to be distressed, and breathing is difficult. There may be a discharge from the eyes and a cough. At later stages, the cough is deep and loud. Infected hogs have fever for a few days. The sickness usually lasts less than a week if permitted to run its course, but treatment may shorten this time.

Treatment and prevention. Veterinarians can inject drugs which may aid in the control of flu, but there is no effective vaccine or serum for the disease. Hogs should be provided with warm, clean, well-ventilated quarters and plenty of fresh water. Healthy pigs fed good rations are less likely to get the flu.

Anemia. This disease was discussed in the previous chapter.

Baby-Pig Disease. This disease is also known as *acute hypoglycemia*, which means "not enough sugar in the blood." The disease affects the pigs during the first three days after farrowing.

Cause. The exact cause is unknown, but the disease is not contagious.

Symptoms. The pigs appear normal at birth but become listless, shiver, and have no desire to nurse. They seem to be cold and burrow in their bedding. They usually die within forty-eight hours after symptoms appear.

Treatment and prevention. The disease is related in some way to the milk production of the sow and to the lack of sugar in the blood. Feeding the sow balanced rations previous to and following farrowing will stimulate milk production. The injection of sugar solution or the hand-feeding of equal parts corn syrup and water at the rate of one to two tablespoonfuls each two or three hours is recommended. The feeding of synthetic milk products may also be tried.

Transmissible Gastroenteritis. Outbreaks of this disease have caused mortality as high as 100 per cent among pigs in some localities. Infected older animals suffer a short-lived diarrhea, which is

followed by loss in weight, but they recover in a few days.

Cause. Research indicates that the disease is caused by a virus or some other filterable organism which can spread from pig to pig by direct and indirect contact. The incubation period is very short, eighteen to twenty-four hours.

Symptoms. The infected pigs vomit and have diarrhea. The feces appear to be partially curdled milk. The pigs become thin and die within three or four days. Postmortem examinations of the pigs show inflammation of the stomach and intestines.

Treatment and prevention. No treatments have been discovered. Penicillin, sulfa drugs, streptomycin, aureomycin, and combinations of these materials have been ineffective to date.

The best means of prevention is to scatter the farrowing places over a wide area. Sows should be moved to clean ground away from other hogs. Any new-bred sows brought onto the farm should be isolated, and sanitation, as recommended for the control of other diseases, should be practiced.

SWINE PARASITES

A parasite is something which lives on, and gets its food from, some other plant or animal. Hogs have a number of parasites. Some live on or under the skin and are called *external parasites.* Others live within the organs of the body and are called *internal parasites.* The latter group of organisms are most injurious to swine.

Roundworms. Large intestinal roundworms, or ascarid, cause hog raisers heavy losses every year. These losses are due to stunting, development of a pot-belly, general weakness, and sometimes death of the pigs.

In tests conducted by the U. S. Department of Agriculture it was found that worm-free pigs fed a well-fortified ration gained an average of 161 pounds in 169 days. Littermate worm-infested pigs fed the same ration gained an average of only 119 pounds. The worm-free pigs gained from 7 to 8 pounds more per month. A comparison of the feeds consumed by the two lots might also indicate that considerable less feed is required by the worm-free pigs to put on a pound of gain.

Life history. The roundworm is a large, thick, yellow or pink worm, about the size of a lead pencil. The adult normally lives in the small intestine. The female produces thousands of eggs

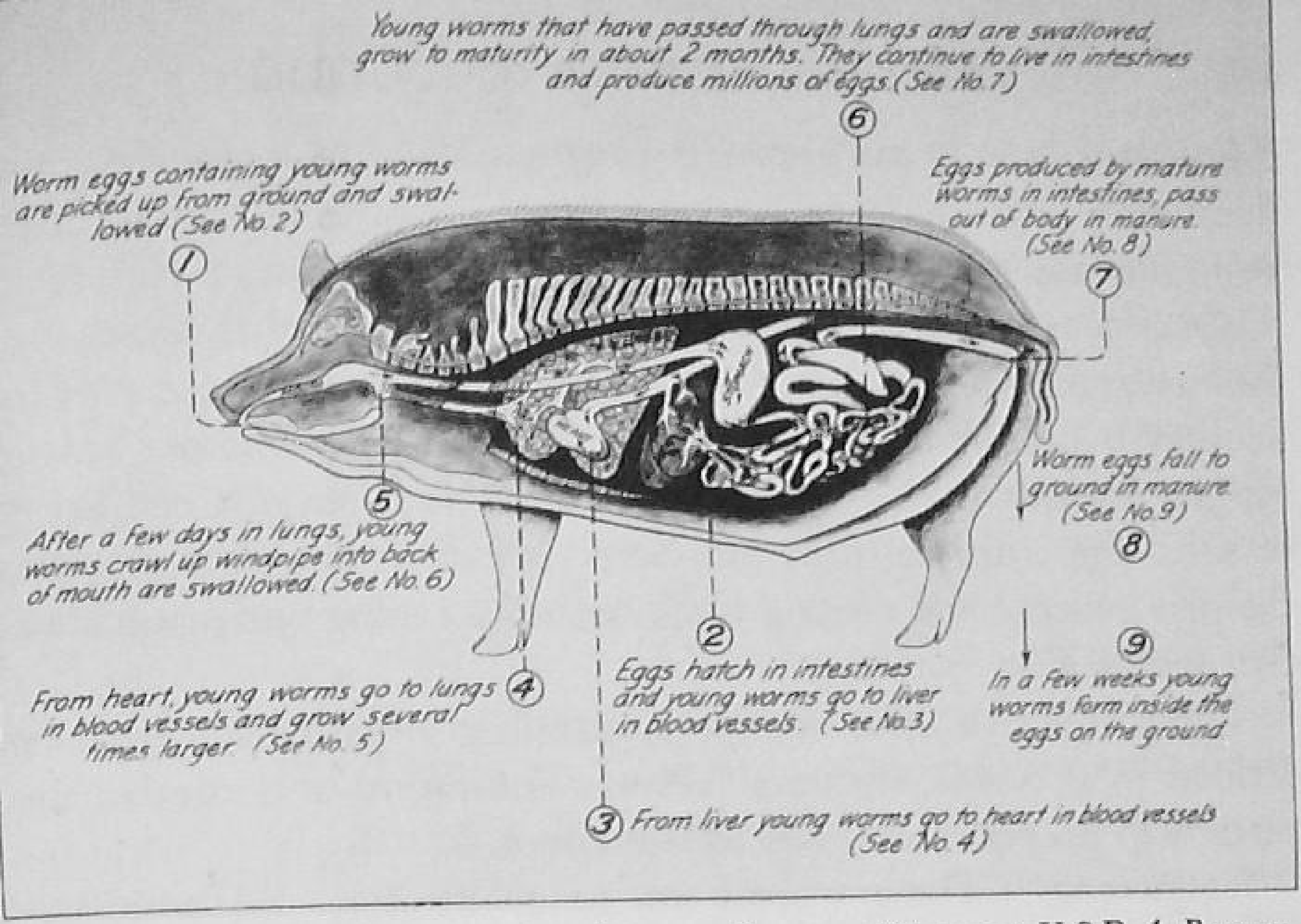


FIGURE 78. *Life cycle of the large swine roundworm.* (Courtesy U.S.D.A. Bureau of Animal Industry.)

daily which are eliminated from the body in droppings. Pigs become infested with roundworms by swallowing the eggs with feed or water. The eggs are abundant in old hog lots and pastures. The young worms hatch out in the pig's intestines. They penetrate the wall of the intestine and travel in the bloodstream to the liver, and on to the lungs. From the lungs they move up to the mouth where they are swallowed. They return to the intestine where they mature in about two to two and one-half months.

Damage. The roundworms in the intestine consume nutrients which the hog needs and cause digestive disturbances. Worms are more injurious to pigs on poor rations than to pigs on good rations. During the time that the young worms are in the lungs, the pig has difficulty breathing, and if exposed to dust or changes in weather, is subject to pneumonia. The liver is also damaged by

FIGURE 79. *These pigs are of the same age. The small ones are suffering from roundworms and other hog-lot infections; the large one is normal.* (Courtesy U.S.D.A. Bureau of Animal Industry.)

the worms, and it can function only in a limited capacity. The worms weaken the pigs, making them susceptible to the many swine diseases.

Treatment and prevention. The most satisfactory treatment for the removal of the worms from hogs involves feeding the pigs for one day a mixture of ground feed containing ¾ to one per cent of sodium fluoride. The pigs do not have to be taken off feed before or after the worming process. Sometimes it is desirable to worm the pigs twice, once about a week before weaning and again about two weeks after weaning.

The preventive measures for controlling worms have been described in previous chapters. Proper sanitation and rotated pastures help prevent losses due to roundworms.

Lungworms. These worms are long, slender, and whitish in color, from ½ to 2 inches long, and threadlike in diameter. They are found in the windpipe, but more often in the two branches of the lower windpipe, and in the lungs.

Life history. The female lungworm produces large numbers of eggs which are coughed up, swallowed, and eliminated with the droppings. The lungworm eggs are swallowed by angleworms. They hatch and develop in the angleworms, and the pigs become infested when they eat the angleworms while rooting. A single angleworm may contain hundreds of lungworm larvae. In the intestines of the pig the lungworm penetrates the intestinal wall and follows the bloodstream to the heart and back to the lungs.

Damage. Lungworms weaken the pigs and cause them to cough, to breathe with difficulty and to grow more slowly. Severe infestations may cause death. Infected animals are susceptible to other diseases and to other parasites.

Treatment and prevention. There is no known treatment for lungworms once they are in the lungs. Sick animals should be isolated from the herd and fed highly fortified, balanced rations.

Lungworms can be controlled quite well by the use of rotated pastures and by the use of sanitary practices during farrowing time and up until the pigs weigh 75 pounds. Old lots should be avoided, and pigs should be rung so that they cannot root in the lots and pastures.

Mange. Mange is a highly contagious skin disease, and although very few animals die as a result of mange, it is the most serious of the external parasites.

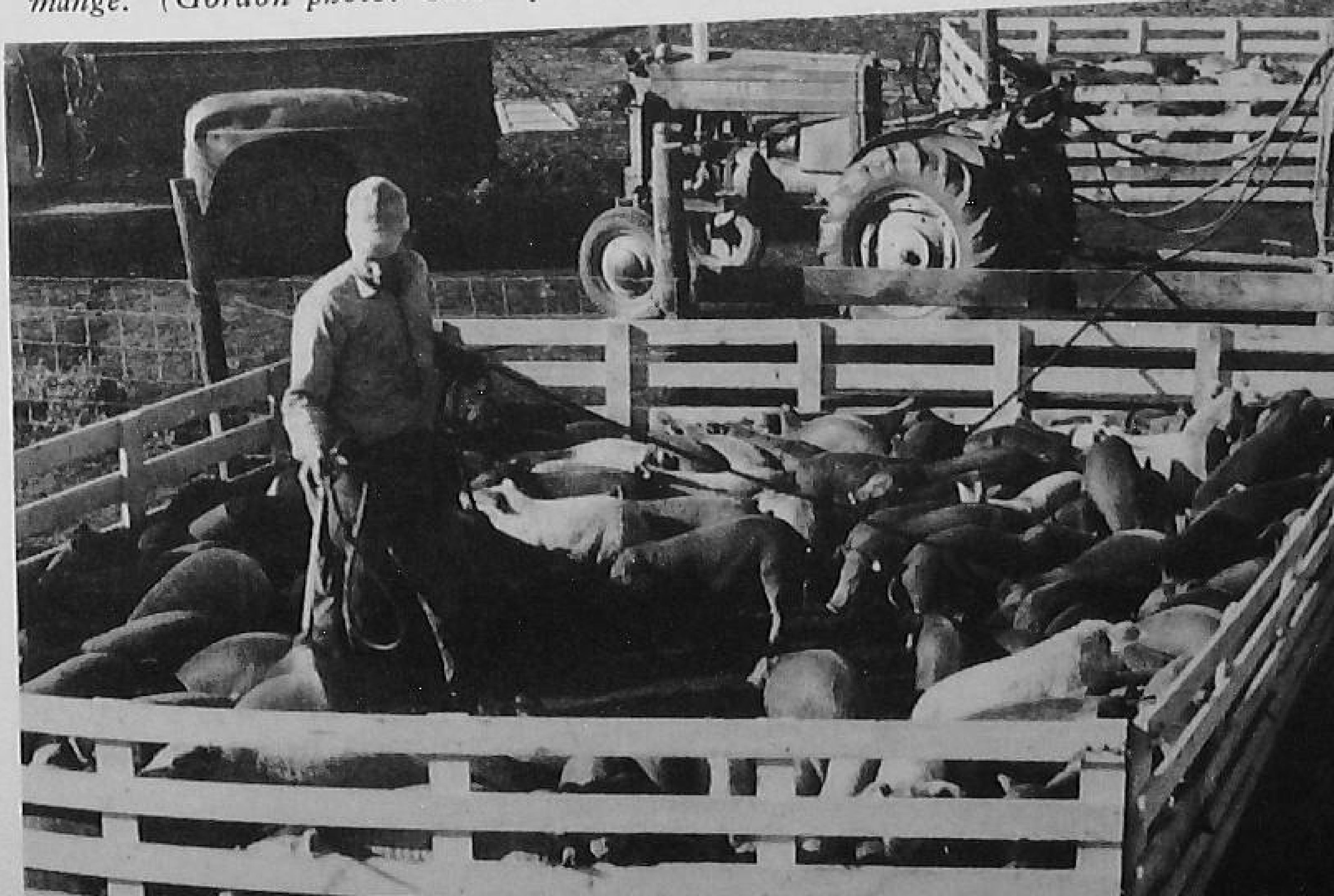
Cause. Mange is caused by a very small mite which spends its entire life on the hogs. It feeds on the tissues of the skin and blood and burrows into the skin, causing a dry, rough, and scaly hide.

Damage. Hog mange causes intense itching, which motivates the hog to bite and rub itself. The infection usually starts around the eyes and ears and along the underline where the skin is tender. It may spread until the entire body is covered with a red rash or heavy scaly hide.

Treatment and prevention. The mite can live in infested quarters for several weeks. Control measures must include a thorough cleaning of the shelters and houses. All manure should be removed, and the surfaces should be disinfected with chemicals or with boiling water.

The chemicals lindane and benzene hexachloride are excellent for use in controlling mange. Lindane should be mixed at the rate of 2 pounds of 25 per cent wettable powder to 25 gallons of water. Benzene hexachloride should be mixed at the rate of 4 pounds of 12 per cent gamma isomer to 25 gallons of water. About ½ pound of detergent such as Dreft or Vel should be added to the solution. The pigs should be sprayed with this solution at the rate of about 2 to 4 quarts per animal. Sows and pigs should be sprayed when it is warm. Brood sows should be sprayed

FIGURE 80. *Pigs are being sprayed with lindane or benzene hexachloride for mange. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



several weeks before farrowing so that the young pigs will not become infested.

When nursing sows are sprayed, they should be thoroughly dry before the pigs are allowed to nurse.

Lice. Hog lice, by their blood-sucking habits, cause some loss to swine producers, and they may be responsible for the spread of infection.

The louse is about ¼ inch long and grayish brown in color. During the winter months it may be found in the ears, in folds of skin around the neck, and around the tail.

The female lays several eggs a day during the winter. These eggs are attached to the hair, and hatch in two to three weeks. They mature in another two weeks.

Treatment and prevention. The lindane and benzene hexachloride treatments for mange will also kill the hog lice. If there is no need for mange control, the hogs should be dusted with a DDT powder or sprayed with a 0.5 per cent DDT solution. One pound of 50 per cent DDT wettable powder mixed with 12½ gallons of water, and ¼ pound of wetting agent, will produce a satisfactory solution. The hogs should be treated as often as necessary.

SUMMARY

Swine diseases and parasites can take much of the profit out of the hog business. Cholera, erysipelas, brucellosis, necro, scours, rhinitis, flu, anemia, and roundworms cause the most serious losses. Vesicular exanthema is the newest disease, and may affect the entire swine industry unless it is kept under control.

Hog cholera and erysipelas can best be controlled by vaccination. The double treatment and the rabbit-adapted hog cholera virus vaccines appear to be the best treatments for cholera. Pigs should be vaccinated at from six to seven weeks of age. The erysipelas treatment should be given when the pigs are less than a week old.

The feeding of antibiotics, highly fortified pig starters, and milk products is the best means of controlling necro. Sanitation and rotated pastures are essential in controlling the diseases of the digestive tract.

Rhinitis, black scours, and brucellosis may be prevented by the isolation of diseased animals and by careful selection of breeding and feeding stock. All swine-breeding stock should be tested for brucellosis, and only animals which have been negative on two

tests, given at least thirty days apart, should be kept.

Flu in hogs can best be controlled by the feeding of well-balanced rations and by proper housing. There is no treatment for gastroenteritis, but it can be controlled, in part, by the isolation of new animals brought onto the farm, and by dividing the herd and pasturing them in areas apart from other hogs.

Sodium fluoride should be used in treating pigs for roundworms. Pigs should be treated just before or just after weaning or both. Rotated pastures and sanitary practices are effective in preventing both roundworm and lungworm losses. There is no treatment for hogs infected with lungworms.

Mange and hog lice can be controlled by dipping or spraying with lindane or benzene hexachloride.

QUESTIONS

1. Which hog cholera treatment is best suited to your farm situation? Why?
2. What would you do if erysipelas was discovered in your home herd?
3. How does atrophic rhinitis differ from bull nose?
4. What is required to have a state-certified brucellosis-free herd in your state?
5. How does black scours differ from necrotic enteritis?
6. What legislation is needed to control vesicular exanthema?
7. How does the life cycle of a roundworm differ from that of the lungworm?
8. Outline a plan for controlling roundworms on your farm.
9. What methods are best in controlling mange?
10. Outline a disease and parasite control program for your farm.

REFERENCES

Dykstra, R. R., *Animal Sanitation and Disease Control*, The Interstate Printers and Publishers, Danville, Illinois, 1949.

Grey, C. G., and Dale, C. N., *Diseases of Swine*, Farmers' Bulletin No. 1914, U. S. Department of Agriculture, 1949.

Schwartz, Benjamin, *Internal Parasites of Swine*, Farmers' Bulletin No. 1787, U. S. Department of Agriculture, 1952.

Seiden, Rudolph, *Livestock Health Encyclopedia*, Springer Publishing Company, Inc., New York, 1951.

Stamm, G. W., *Veterinary Guide for Farmers*, Windsor Press, New York, 1950.

Zavoral, H. G., *Hog Health Makes Wealth*, Extension Bulletin 119, University of Minnesota, 1950.

< 10 >

Marketing Hogs

The efficient hog raiser tries to plan his breeding and feeding operations so that he will have hogs of the weight and conformation desired by the packer and consumer ready for market when the price is most favorable. With feed and pasture available, and no serious disease problems, it is possible to have hogs ready for market in five or six months. By planning breeding operations and allowing a five- or six-month growing-out period, it is possible to plan the time the hogs will be ready for market.

We are not always able to predict so accurately the season when the price will be best. Hogs of certain weights sell better during some months than during others. The number of hogs going to market varies seasonably, and when hogs are plentiful, the price goes down. When few hogs are being marketed, the price is higher. Farmers who follow the markets from year to year are usually able to anticipate the best time to market their hogs.

Most farmers find it necessary to make changes in their breeding and feeding methods in order to have their pigs at marketable weights at the time that the price is best. At times it is necessary to decide whether the increased selling price of the hogs will offset the costs of the changes in production. Each farmer must analyze his swine enterprise and decide upon the production and marketing program best suited to his farm.

Swine producers, through breeding and feeding practices, can control the type, quality, and finish of the hogs which they produce. A check of the prices paid by packers for various grades and weights of hogs will indicate the kind of hog which will bring the most money. The efficient hog raiser produces the kind of hog desired by the packer and by the consumer. He plans ahead. He has the desired type of hog at the preferred weight when the packer and consumer need it.

CHANGES IN THE HOG MARKET

It was pointed out in a previous chapter that today the consumer is buying less lard and fat pork than he purchased a few years ago. The housewives who buy meat are guiding farmers in the production of quality pork. They are demanding leaner cuts. They bypass pork chops with an inch of fat for lean chops, or they buy poultry or beef instead. As a result the demand for pork has been reduced.

With nearly 93 million head of beef cattle on our farms, we can expect beef to be plentiful the next few years. This supply spells cheaper beef and more competition for pork.

The fast-growing broiler industry provides another area of competition. In 1940 about 816 million pounds of live birds were produced. More than 1½ billion pounds were produced in 1950.

The Lard Problem. At one time lard sold wholesale for more than live hog prices. This was before vegetable fats and oils entered the picture. Lard had an important place in our diets, and we had a good export market. The situation has changed. Wholesale lard during the past years has been selling for considerably less than the price of live hogs. The prices of lean cuts of pork have advanced, and the prices of fats have declined.

In 1951 the retail selling price of pork chops was more than three times the retail selling price of lard. Table 12 shows the retail prices of various pork products from 1940 to 1951. In 1949 the average cost of hogs in Chicago was $18.40 per 100 pounds. Lard at that time sold for $12.03 per 100 pounds.

TABLE 12

AVERAGE RETAIL PRICES OF PORK CUTS AND LARD 1940–1951 *

Year	*Pork Chops*	*Ham (Whole)*	*Bacon (Sliced)*	*Lard*
1940	27.9	24.3	27.3	9.4
1941	34.3	30.4	34.3	12.7
1942	41.4	37.4	39.5	17.2
1943	40.3	37.7	43.1	19.0
1944	37.3	35.4	41.1	18.7
1945	37.1	34.7	41.1	18.8
1946	48.5	47.8	53.3	26.3
1947	72.2	67.5	77.7	31.5
1948	77.2	68.0	76.9	29.6
1949	74.3	63.4	66.5	19.2
1950	75.4	62.0	63.7	19.1
1951	79.4	66.5	67.2	24.6

* U. S. Department of Agriculture, *Livestock Market News Statistics and Related Data*, Statistical Bulletin No. 118, November, 1952.

Hog raisers and packers have a joint responsibility in making available to the consumers a better quality pork product. Hogs with more lean meat must be produced, and they must be marketed at a reasonable weight. We need lean meat, but we must reduce lard production. There are two ways of doing this: (1) producing a better muscled, meat-type hog, and (2) marketing our hogs at lighter weights.

The Meat-type Hog. The meat-type hog is being developed to meet the changes in demand for pork products. It is not a new breed. We have meat-type hogs in all of our standard breeds. Several new breeds, however, have been developed in an effort to improve the carcass quality of our hogs. The Beltsville No. 1 and No. 2, the Montana No. 1, the Minnesota No. 1 and the Minnesota No. 2 are some of the new breeds which have been developed.

The meat-type hog has been described as one with more than average length and with a natural tendency to yield a carcass with a high proportion of the high-priced meaty cuts. The carcass of a 200-pound hog should measure about 30 inches long, and the layer of backfat should not exceed 1½ inches. On the hook, the carcass should have a high ratio of lean to fat with approximately 50 per cent of the carcass weight in the four lean cuts of hams, loins, picnics, and Boston butts.

Cost of producing meat-type hogs. Many farmers believe that it costs more to produce a heavily muscled meat-type hog than it does to produce a hog carrying more lard. This is not true. In tests conducted at Iowa State College, hogs with less than 36.9 per cent lean cuts and 26.4 per cent fat cuts weighed 229 pounds at five months of age and used 340 pounds of feed to produce 100 pounds of gain. Pigs which had more than 41 per cent of lean cuts and 22.9 per cent of fat cuts weighed 227 pounds at five months, and used only 333 pounds of feed to produce 100 pounds of gain.[1]

TIME TO SELL

Two pig crops are normally produced each year. One is farrowed in the spring and is ready for market in the fall. The other is farrowed in the late summer, and is sold in the spring. The bulk of the year's hog production is marketed during these two periods. A large share of the fall-farrowed pigs are marketed in March, April, and May; the bulk of the spring pigs are marketed in Octo-

[1] Unpublished data obtained from Dr. L. N. Hazel, Animal Husbandry Department, Iowa State College, Ames, Iowa.

ber, November, and December. The supply of hogs during the two marketing periods is such that packers can buy hogs at lower prices than they can during other seasons.

Seasonal Price Variations. Figure 81 shows the variation in the monthly prices of hogs for a five-year period. Light butcher hogs bring the most money in July, August, and September. Pigs have

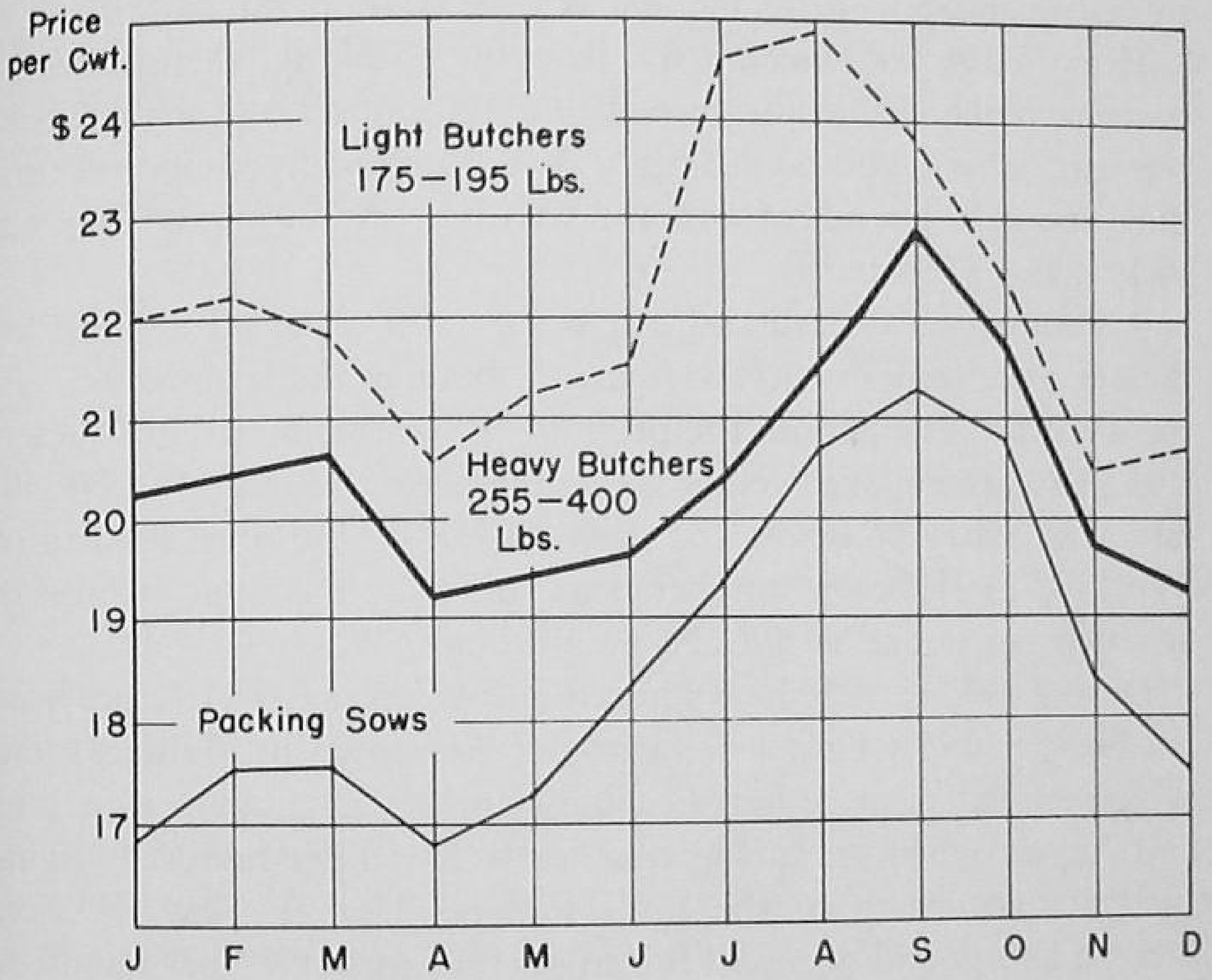


FIGURE 81. *Hog prices by months—five-year period, 1947–1951, Chicago.*

to be farrowed in February and March to be ready for this market. The supply of hogs in November and December exceeds the demand, and the price is much lower. Based upon prices over the five-year period, light butcher hogs sold in July brought $4.25 per hundred more than they would have had they been sold in the late November or December market. A farmer selling 200 pigs averaging 200 pounds would net about $8.50 more per pig, or a total of $1700, by selling them in July rather than in December.

Since more pigs are produced in the spring than in the fall, there is less variation in the prices received for fall pigs. February and early March is usually the best time to market fall pigs. August and September pigs can quite easily be fed out in time to get them on the high market. The spread in prices paid for hogs between February and April was a little under $2 per hundred.

WEIGHT TO SELL

The consumer wants smaller and leaner cuts of pork and less lard, and the consumer must be satisfied if pork is to meet the competition of other meats. Consequently, farmers must grow meatier hogs and market them at lighter weights; hog raisers will have to produce more litters per year to feed out home-grown grains and to realize the same gross income as they have in the past.

Heavy Hogs are Discounted. Roughly speaking, there is nearly twice as much lard in the carcass of a 300-pound hog as there is in the carcass of a 200-pound pig. A 200-pound live hog will produce about 30 pounds of lard and backfat. A 300-pound hog will yield about 55 pounds.

A comparison of lard and hog prices over a period of years indicates the changes which have come about in the lard market. In the 1910 to 1919 period, the price of prime-steam lard at Chicago was $4.40 per hundredweight above the price of hogs. In 1949–50, lard was nearly $6 below the price of hogs. Up until the end of World War II, heavy butcher hogs sold on an average for nearly as much per pound as did 200-pound hogs.

During 1947 to 1950 heavy butcher hogs averaged $1.72 per hundredweight under light weight hogs. As shown in Figure 81, the widest spread in price between light and heavy hogs was in July and August when the spread was nearly $3.50 per hundredweight. In 1952, according to the Iowa Federal Market News Service, 200- to 240-pound pigs sold for an average of $18.42 per hundredweight, whereas 270- to 330-pound hogs sold for $17.27 per hundredweight. These data emphasize the importance of selling hogs at light weights.

Light Hogs Make Cheaper Gains. Swine producers are interested in economical use of feed, and it is known that young animals make cheaper gains. Tests conducted at the University of Minnesota [2] indicated that lighter hogs used less feed and made cheaper gains than did heavier hogs. Their data were as follows:

Weight of pigs (in Pounds)	*Feed for 100 Pounds Gain*
Birth–100	304 lbs.
100–200	359 lbs.
200–300	415 lbs.
300–400	470 lbs.
400–500	510 lbs.

[2] University of Minnesota, *The Little Woman is Changing the Hog Market,* Extension Folder 151, 1951.

These data applied to 1953 prices show the cost of feed in producing the 200-pound hog to be $9.39 per hundredweight. The cost in producing the 300-pound hog would be $10.27 per hundredweight. It takes more feed, and it costs more to feed out heavy hogs than to feed out light hogs, and the light hogs sell for a higher price. Light hogs are more profitable.

MARKET CLASSES AND GRADES OF HOGS

Market hogs are classified in terms of sex, use, weight, and value. Classes are provided for barrows and gilts, sows, stags, and boars. Animals are classified according to use, as slaughter hogs, slaughter pigs, stockers, and feeders. The weights vary with the classes according to sex and use.

Two systems of grading are in use. The standard system classifies animals as choice, good, medium, and cull. On September 12, 1952, the United States Department of Agriculture announced new grade standards for barrows and gilts. The five grades recommended were Choice No. 1, Choice No. 2, Choice No. 3, Medium, and Cull. These grades were recommended for voluntary use by farmers, dealers, packers, and market specialists. They are being used by the U. S. Department of Agriculture Market News Service. These grades are not in use by packers at all markets.

A systematic grading procedure makes it possible for hogs to be marketed according to the value of their carcasses or according to the value of the animals as stockers or feeders. Market grades of hogs serve the same purposes as grades of corn or grades of butter. Prices are quoted for the various grades, and it is possible for both the buyer and seller to make comparisons before making market transactions.

U.S.D.A. Hog Grades. The five grades established by the U. S. Department of Agriculture apply to hogs on foot and on the hook. The degree of finish, the quantity and the quality of the lean meat, and the percentage of fat determine the grade. The three top, or choice, grades are numbered from one to three according to the percentage of lean meat in the carcass. The other two grades, "medium" and "cull," are so called because of underfinish and poor quality of lean meat cuts.

The use of these grades is voluntary. A mandatory system of grading beef was required by the Office of Price Stabilization. No such system was used with pork.

TABLE 13

MARKET CLASSES AND GRADES OF HOGS AND PIGS

Use	*Sex*	*Weights (Pounds)*	*Grades*
HOGS:			
Slaughter hogs	Barrows and gilts	Under 180 180–240 240–300 300 and over	Choice No. 1 Choice No. 2 Choice No. 3 Medium Cull
	Sows	270–300 300–330 330–360 Fat Type 360–400 Meat Type 400–450 450–500 500–600 600 and over	Choice Good Medium Cull
	Stags	All weights	Ungraded
	Boars	All weights	Ungraded
	Unclassified	All weights	Ungraded
Feeder and stocker hogs	Barrows and gilts	120–140 140–160 160–180	Choice Good Medium Common
PIGS:			
Slaughter pigs	All classes	Under 30 30–60 60–80 80–100	Ungraded Ungraded Good Medium Cull
	Barrows and gilts	100–200	Choice Good Medium Cull
Feeder pigs	Barrows and gilts	Under 80 80–100 100–120	Choice Good Medium Cull

The thickness of backfat in relation to the length, weight, and dressing percentage of the carcass serves as the basis for determining the grade. The five grades and the qualifications for both the live animals and carcasses follow:

Choice No. 1. These hogs have the minimum of finish necessary for high-quality pork cuts. The carcasses have a high ratio of lean to fat, and the hams, loins, picnics, and Boston butts make

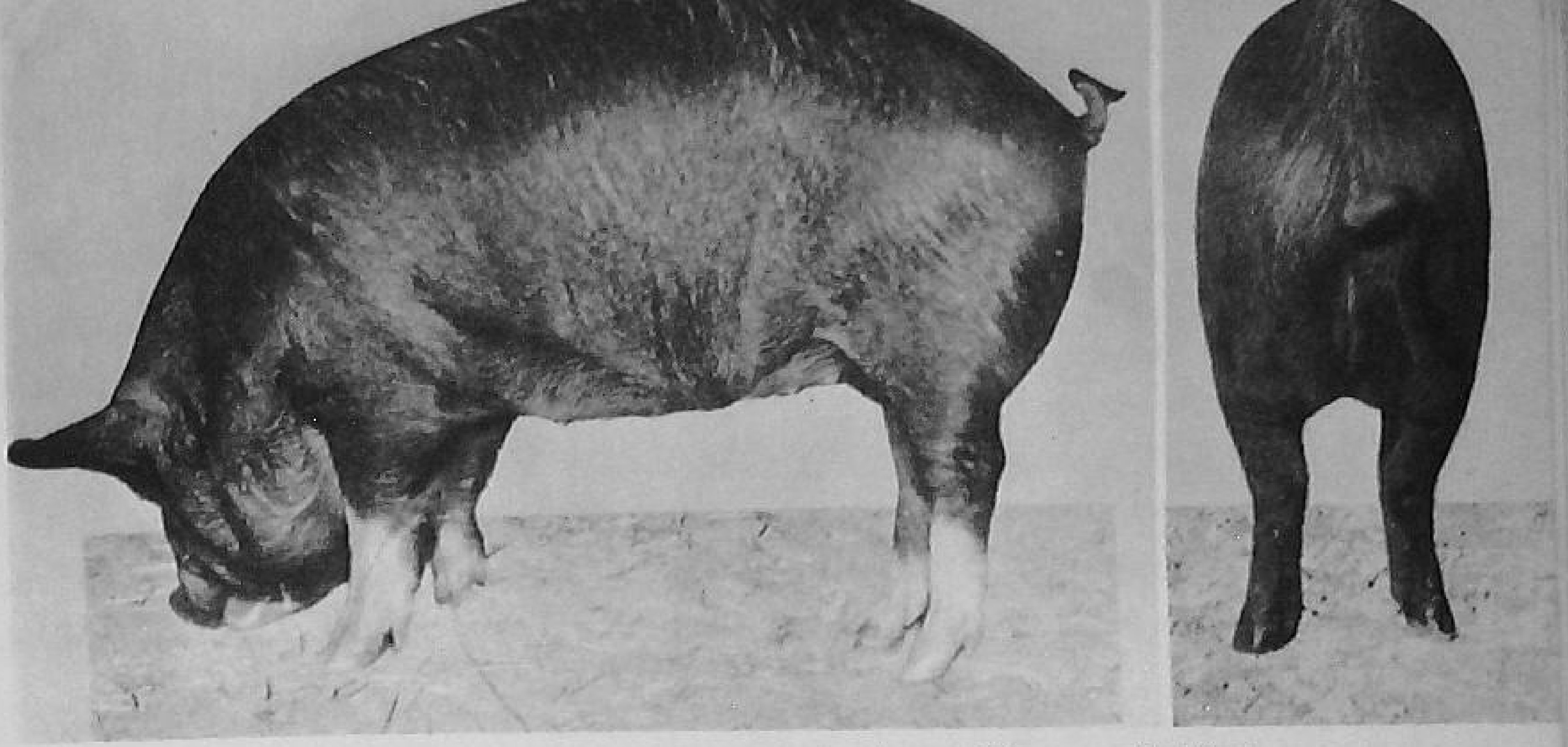


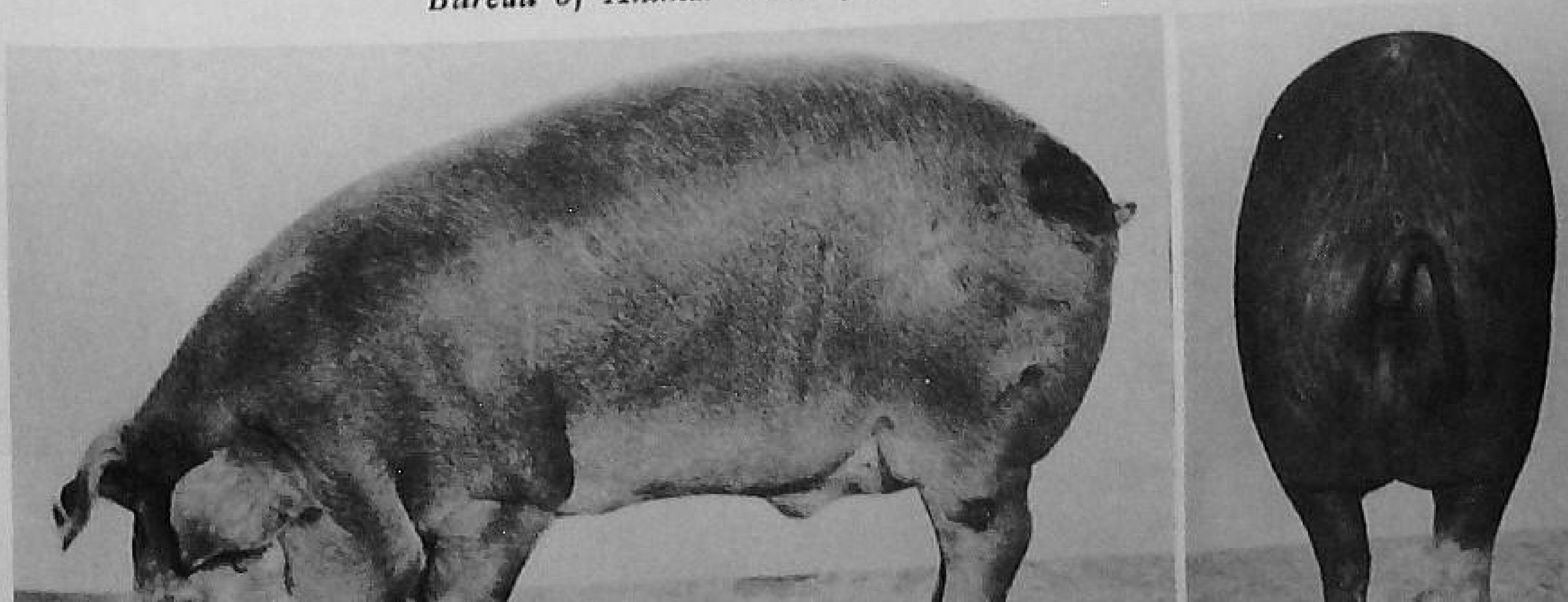
FIGURE 82. *(left and right) U.S. Choice No. 1 market hogs. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

up about 50 per cent of the carcass weight. The carcass of a 200-pound Choice No. 1 hog is nearly 30 inches long and has from 1.5 to 1.6 inches of backfat.

Choice No. 2. These hogs produce high-quality pork, but are slightly overfat. The carcasses are the same length as Choice No. 1, but usually the backfat is from 1¾ to 2 inches thick. The carcasses yield from about 45 to 48 per cent of their weight in the four lean cuts.

Choice No. 3. This grade designates hogs which possess high-quality pork but which are decidedly overfat. Their carcasses yield less than 45 per cent of their weight in the four lean cuts. The backfat on a 200- to 240-pound shoat will be 2.1 inches or more.

FIGURE 83. *(left and right) U.S. Choice No. 2 market hogs. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



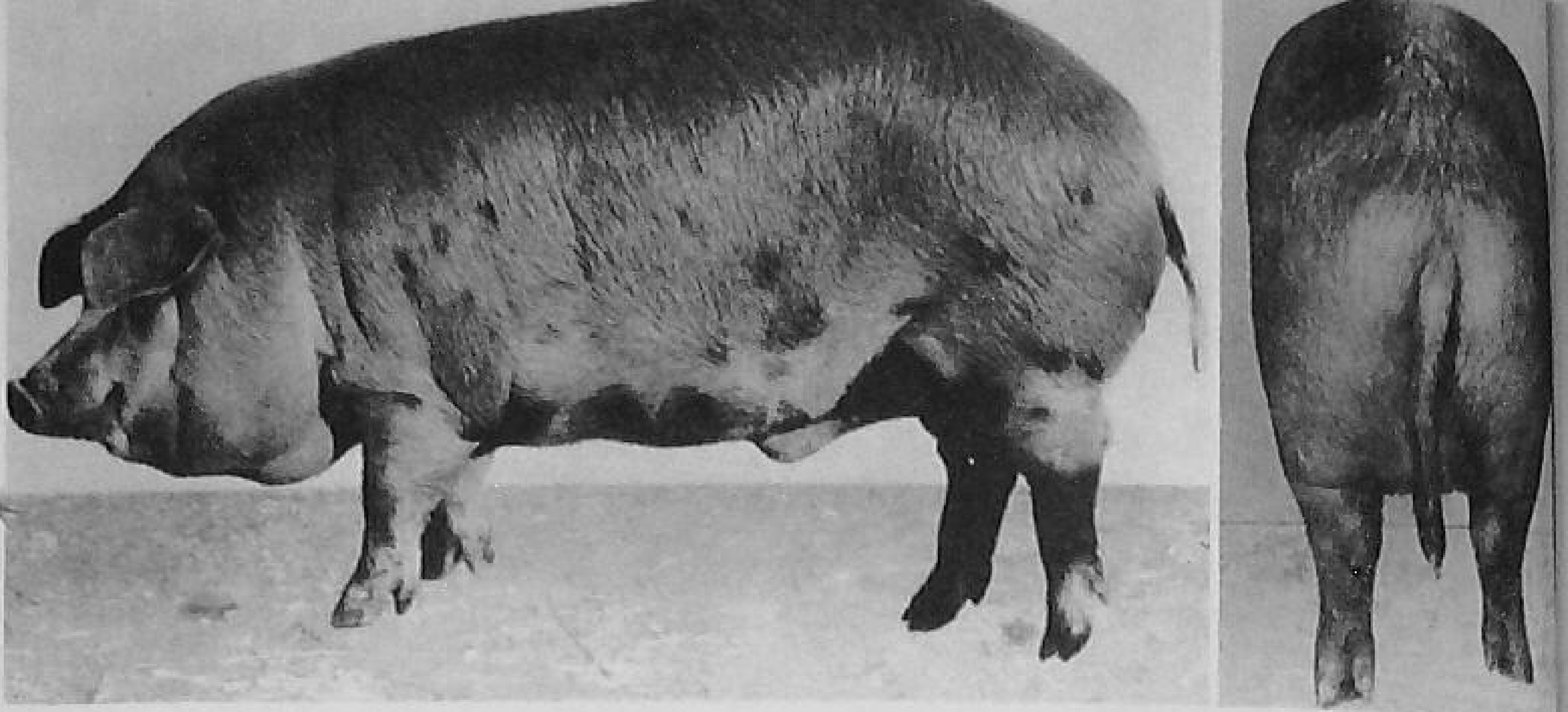


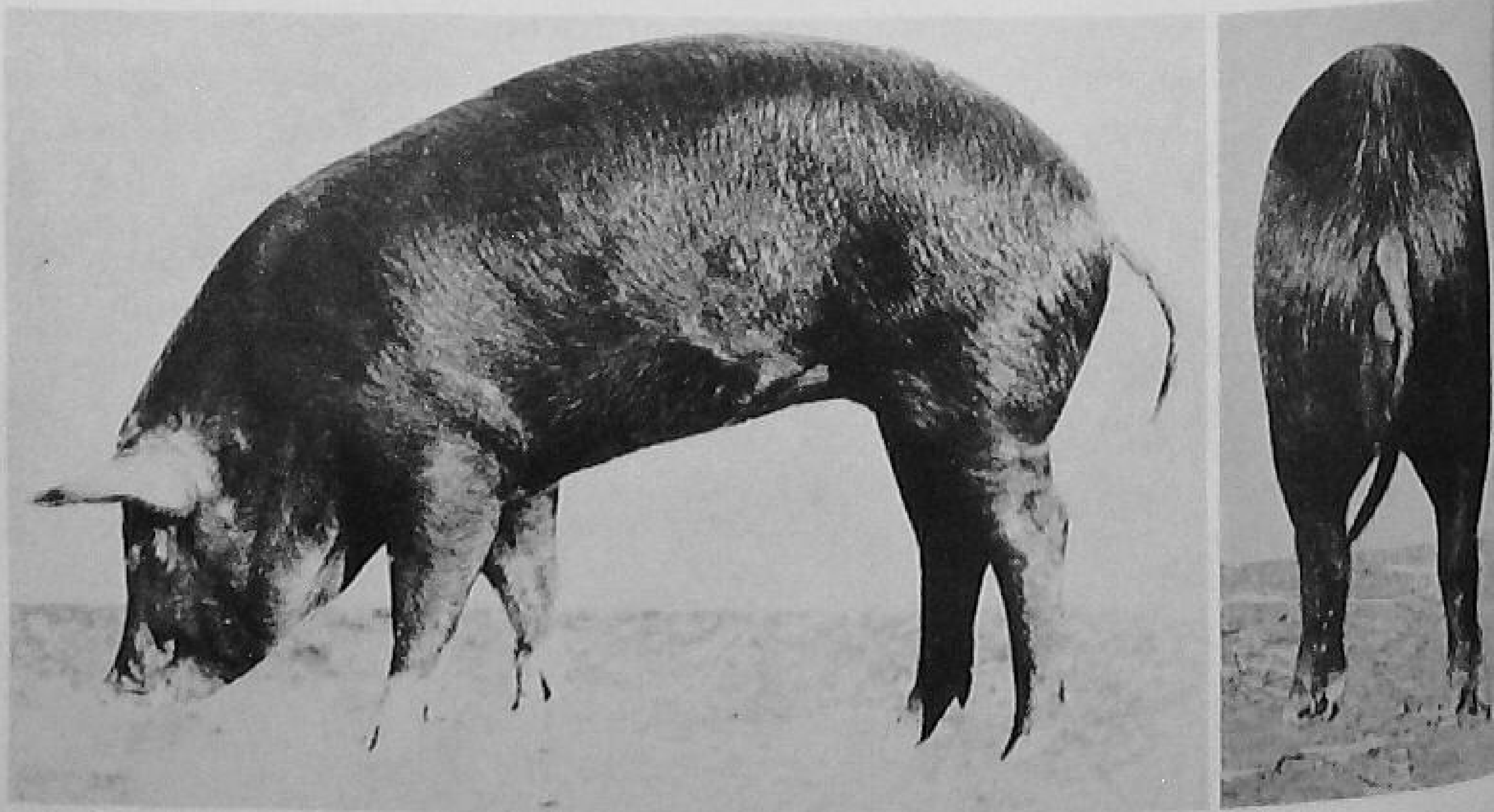
FIGURE 84. *(left and right) U.S. Choice No. 3 market hog. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

Medium. These hogs are slightly underfinished. The cuts are flabby and soft. The proportion of lean to fat may be high, but the carcasses are poorly marbled. The backfat on a 200-pound hog may be less than 1.5 inches.

Cull. Hogs of this grade are decidedly underfinished. The cuts are inferior even though the ratio of lean to fat is high. The backfat may be only about an inch thick.

Measuring backfat thickness on live hogs. Dr. L. N. Hazel of Iowa State College has developed a probing technique for use in measuring the backfat on live hogs. An incision is made in the skin with a sharp knife just back of the shoulder and about 1½ inches to the side of the centerline. A graduated ruler is placed in the incision and pushed downward into the fat until the ruler encounters the muscle tissue. The method does not cause much pain because there is little nerve tissue in the fat.

FIGURE 85. *(left and right) U.S. Medium market hog. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



SELLING HOGS ACCORDING TO CARCASS WEIGHT AND GRADE

The new government grades represent an attempt to satisfy hog producers who have felt that packers were not paying for quality hogs. Market quotations have usually been based upon the weight of the hogs rather than upon quality. It is difficult to grade hogs on foot, and most packers have preferred to buy them by the pound in droves or loads. There has been little incentive for hog breeders to improve the carcass quality of their hogs for they all sold at the same price.

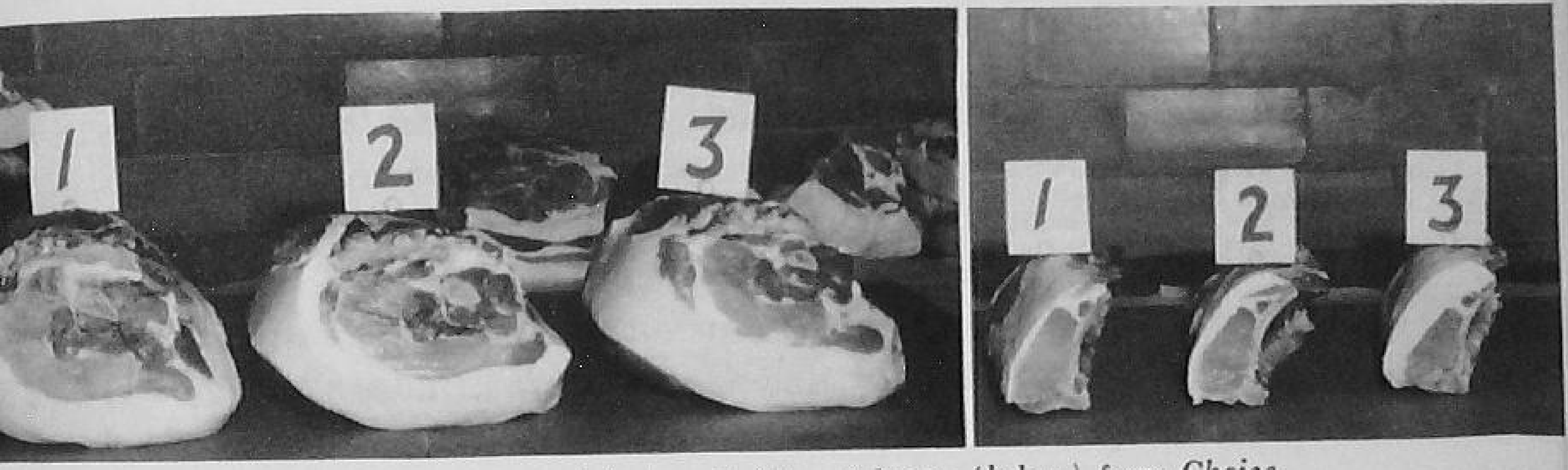


FIGURE 86. *Hams (left), loins (right), and sides of bacon (below) from Choice No. 1, Choice No. 2, and Choice No. 3 market hog carcasses. (Courtesy Rath Packing Company.)*

Advantages of Selling Hogs by Carcass Grade. The demand of the housewife for leaner pork cuts and the loss of our lard market makes it imperative that we improve the quality and popularity of pork. Selling hogs on the basis of carcass grade and weight will encourage farmers to produce quality hogs and will eliminate the wasteful practice of "filling" hogs to get the maximum market weight. Selling by carcass grade should provide the producer with an unbiased evaluation of the quality of his hogs, and it will also permit the tracing of diseased, injured, and inferior pork carcasses to the producers who are responsible.

Hogs have been sold by carcass grade in Denmark, Sweden, Great Britain, and Canada, and the method has proved efficient and practical. Some packing plants in the Corn Belt have purchased hogs on this basis for several years. In general, breeders with high-quality hogs profit by selling their hogs on a carcass-grade basis, whereas hog producers with below-average hogs profit by selling them in the traditional manner.

Disadvantages of Selling Hogs by Carcass Grade. One of the chief reasons for delay in selling hogs by carcass grade is that the packer buyers have had neither the facilities nor the personnel to do the job. The procedure requires more time and physical facilities than does the present system. Buying by carcass grade is less flexible than the present system. There is less opportunity for both the buyer and seller to bargain. Quite often the grading is done in the absence of the seller, who may later question the results. Many farmers are not sufficiently informed in regard to carcass quality to accept the packer's judgment. Another serious objection to the system is that the seller must wait until the hogs have been slaughtered and processed before he can receive his check.

CHOOSING A MARKET

Let us assume that, during early March, you have thirty-four fall-farrowed pigs ready for market as Choice No. 1 slaughter hogs. Where should you sell them? Several times each year almost every hog raiser is confronted with this, or a similar, problem regarding the best hog market. There is no stock answer to the question. The answer depends upon where you are located.

Markets Available. In every community we have local hog buyers, dealers, and livestock auctions. In many communities we can consign our hogs and sell through a cooperative shipping association. Some meat packers have concentration yards or buying plants in our communities. We can truck our hogs to interior packing companies located twenty to fifty miles away, or we can put our hogs with the neighbors' and truck or ship them by rail to public stockyards at a central market, such as Chicago or Kansas City. We can ship direct to the packer, or we can sell them through a commission firm. Which is best?

Factors in Choosing a Market. A number of factors are involved in the selection of a market. Distance, transportation problems, shrinkage, methods of grading, handling and selling charges, de-

pendability, and price quotations are perhaps the most important.

To market effectively you need to know the price at each available market of the grade you have to sell. You may have a half dozen or more markets to choose from. The U. S. Department of Agriculture Market News Service, the various cooperating radio stations, and the newspapers supply market information. At times a telephone call may result in several dollars more in profits.

In addition to the kind of hogs which you have to sell, you need to know the cost of transporting them and the shrinkage you may expect. If you consign to a terminal market, there will be a commission or handling charge. This may amount to from 20 to 30 cents per hundredweight. The transportation cost will vary with the number of hogs to be transported and with the distance to be covered. The shrinkage and loss due to injury or death will vary with the method of transporting and with the distance. These losses may be as little as 10 cents or as large as 60 cents per hundredweight.

To illustrate, let us assume that we can sell the thirty-four hogs mentioned previously at Market X or at Market Z. Following is a summary of the probable net income per 100 pounds:

	Market X	*Market Z*
Probable gross price per cwt.	$22.40	$21.80
Probable expenses:		
Transportation cost per cwt.	.50	.15
Market expense per cwt.	.30	.00
Shrinkage, loss, etc., per cwt.	.50	.15
	$1.30	$ .30
Net return per cwt.	$21.10	$21.50

Assuming that the hogs weighed 200 pounds, you would net 80 cents more per animal by selling them at Market Z. The thirty-four head would net $27.20 more than they would have had they been sold at Market X.

CARE IN MARKETING HOGS

In 1951 nearly 80 per cent of the hogs received at all public markets arrived by truck. In 1949, approximately one million hogs arrived by rail at five markets, Kansas City, St. Joseph, Omaha, Sioux City, and St. Paul, and eight million arrived by truck. Of those arriving by rail, 693 were dead and 2728 were crippled; of those arriving by truck, 14,419 were dead and 28,841 were crip-

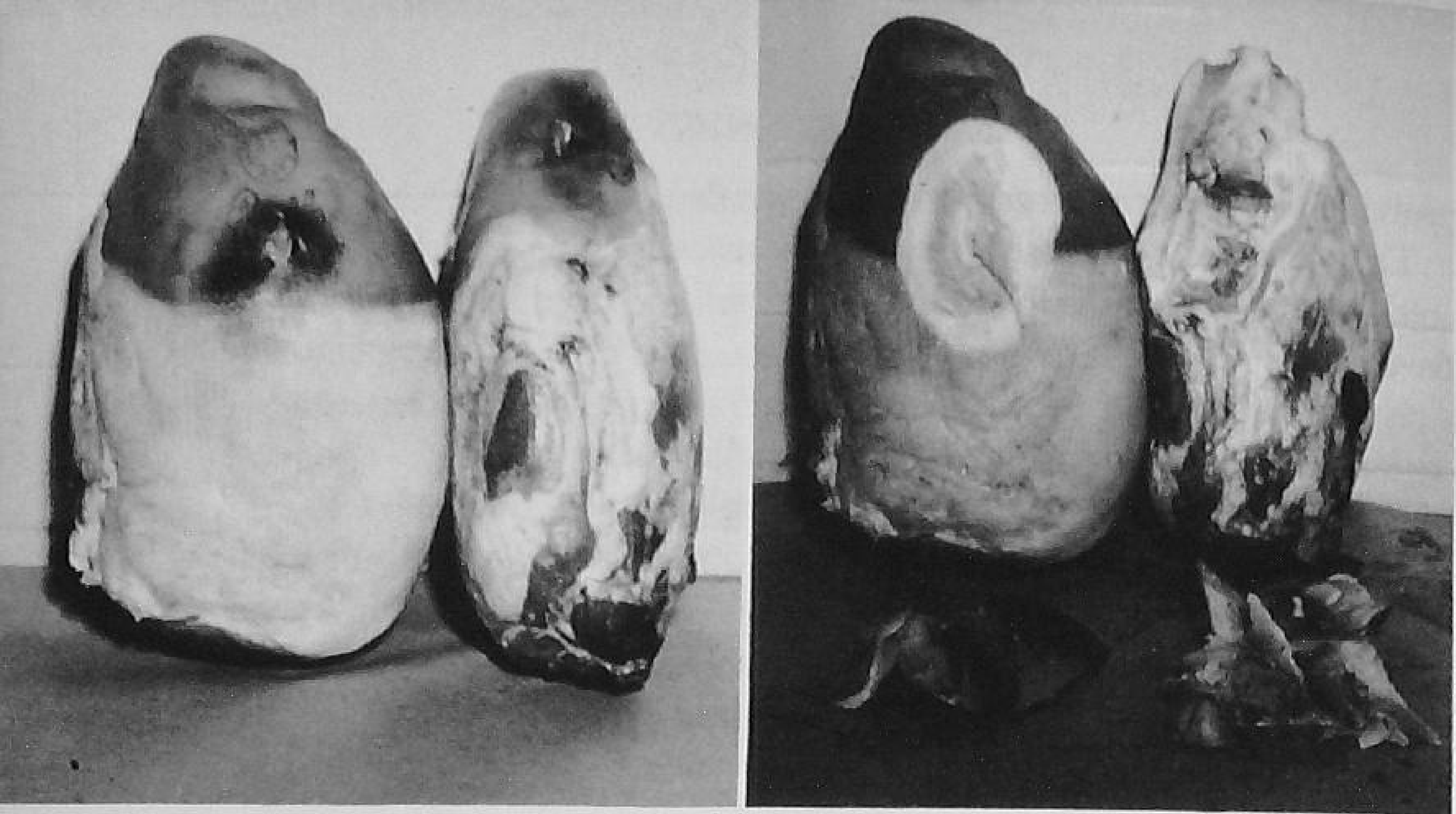


FIGURE 87. *(left and right) Hams showing bruises and the removal of the bruised sections. (Courtesy Rath Packing Company.)*

pled. A total of 5708 hogs were bruised, and most of the bruises were on the hams, the most valuable part of the carcass. Care in loading and in handling these hogs in shipment could have reduced these losses. There is less danger of hogs being killed or crippled while being transported by rail than while being transported by truck. The increase in the number of interior packing plants, however, has increased the number of hogs being marketed by truck.

Shipping Pointers

1. Do not feed hogs heavily before shipping.
2. Allow 3½ square feet of floor space in the truck for each 225-pound hog.
3. Clean truck or car before loading.
4. Use sand for bedding in hot weather and straw, or sand and straw, during cold weather.
5. Separate heavy from light hogs in truck or car.
6. Wet hogs and bedding during hot weather.
7. Remove all boltheads and nailheads and other obstructions from the loading chute and truck.
8. Have adequate loading equipment.
9. Handle hogs quietly and with care.

SUMMARY

Your breeding and feeding operations should be planned carefully in order to have Choice No. 1 hogs ready when the market

is best. A leaner, better muscled market hog should be produced and sold when it weighs from 200 to 225 pounds. Unless we market hogs of higher quality, the consumer will buy beef and poultry. Because our lard market is gone, we should produce less of it. A 300-pound hog produces nearly twice as much lard as does a 200-pound hog.

A meat-type hog can be produced more cheaply than can a lard-type hog. Lighter hogs produce 100 pounds of gain on less feed than do heavy hogs. Heavy hogs sell for from $1 to $3 less on the market than do 200-pound hogs.

To get the best price, spring pigs should be sold in July, August, and September and fall pigs in February and March. The difference between high and low markets may be as much as $3 to $4 per hundredweight.

The new U.S.D.A. grades are Choice No. 1, Choice No. 2, Choice No. 3, Medium, and Cull. Hogs should be sold as they reach the Choice No. 1 grade, not held until they are overfat and grade down to Choice No. 2 or Choice No. 3. Good feeding and breeding methods will help you avoid producing medium and cull hogs. The U.S.D.A. grades are based largely upon leanness of carcass, backfat percentage, length of carcass, finish, and weight. Selling hogs by grade will encourage farmers to improve the quality of hogs which they produce.

A market should be chosen carefully. The net return after transportation, shrinkage, and other costs have been deducted is the determining factor. Care in trucking and shipping will prevent losses, injuries, and bruises. The truck should be carefully bedded down and not overloaded. Each 200-pound pig should have 3½ square feet of floor space.

QUESTIONS

1. Why does the packer pay more per hundredweight for a 225-pound hog than for a 280-pound hog?
2. What percentage of the carcass of a hog should be of the four primal cuts—hams, loins, picnics, and Boston butts?
3. What is the difference between the U.S.D.A. grades and the old grading system?
4. What goes to make up a Choice No. 1 hog?
5. Which will make the most economical gains, a 100-pound pig, a 200-pound hog, or a 300-pound hog?
6. Does it cost more to produce a meat-type than a lard-type hog?

7. In which months should spring pigs be sold to bring in the most money? When should fall pigs be sold?
8. How much variation occurs in the price of light hogs during the year?
9. How much less do you get per hundredweight for a 300-pound hog than for a light 200-pound hog?
10. How will you select the market through which you will sell your hogs? What factors will you consider?
11. What precautions do you need to take in transporting market hogs?
12. Would you prefer to sell hogs by carcass grade or by weight? Why?
13. How can you improve the income from your home hog enterprise through better marketing practices?

REFERENCES

Anderson, Arthur L., *Swine Management*, J. B. Lippincott Company, Philadelphia, 1950.

Clifton, E. S., "How Much Are Your Hogs Worth?" *Iowa Farm Science*, Iowa State College, Vol. 7, No. 9, March, 1953.

Day, O. A., *Trends in the Livestock and Meat Business*, Wilson & Co., Chicago, 1951.

Ensminger, M. E., *Swine Husbandry*, The Interstate Printers and Publishers, Danville, Illinois, 1952.

McMillen, W. N., *Hog Profits For Farmers*, Windsor Press, New York, 1952.

Meyer, A. R., and Whittle, Boyd, *What's Wrong With the Way We're Marketing Hogs?*, Extension Service News, University of Maryland, October, 1952.

Morrell & Co., *A Livestock and Meat Manual*, Ottumwa, Iowa, 1951.

Smith, W. W., *Pork Production*, The Macmillan Company, New York, 1952.

Thompson, Sam H., "Choosing The Right Hog Market Can Increase Returns," *Iowa Farm Science*, Iowa State College, Vol. 7, No. 5, November, 1952.

U. S. Department of Agriculture, *Livestock Market News Statistics and Related Data 1951*, Statistical Bulletin No. 118, November, 1952.

Profitable Beef Production

< 11 >

The Beef Production Industry

"We are having steak for dinner." These words seldom have to be repeated to bring an American family to the dinner table. Beef is one of the more important meats in the American diet. It is high in nutritional value, and many people consider it first in flavor. The fact that we consumed an average of 69 pounds of beef per person during 1947 is evidence of the importance of beef in our eating habits. The per capita consumption dropped to 58 pounds in 1951 because less beef was available.

We started the year 1952 with a record number of 88 million cattle on the range and feed lots of the United States. Although this represents a record number of cattle, it is not a record number per person. In the year 1900 we had 79 head of cattle per hundred persons, whereas the 1952 ratio was 56 head per hundred persons.

With our ever-expanding population, there will be an even greater demand for beef in the future than there has been in the past. Beef producers must meet this challenge. They must produce at a profit more beef per acre of farm land, and they must furnish beef to the consumer at a price he can afford to pay.

OPPORTUNITIES IN BEEF PRODUCTION

Opportunities in beef production are numerous. Most any young man with a love for livestock, an eagerness to learn, and a willingness to work can find a life of satisfaction in some phase of the beef production industry.

CLASSES OF BEEF CATTLE PRODUCERS

The three main divisions of the beef cattle production industry that one may enter are: (1) the production of feeders, (2) the production of fat or slaughter cattle, and (3) the purebred beef cattle industry. It is also possible under certain conditions to

FIGURE 88. *Typical western range scene. The calves from these cows will be shipped into the Corn Belt for fattening. (Courtesy American Hereford Association.)*

develop a program combining two or more of the above phases of the beef industry.

Production of Feeders. The production of feeders is carried on primarily by producers located on lands that are generally not suitable for heavy crop production other than grass.

These farmers and ranchers maintain herds of cows to produce calves. The calves are usually dropped in the spring and run with the cows on the pasture or the range during the grass season. In the fall the calves are weaned from their mothers and sometimes sold as feeder calves to someone in the grain area. They may be carried through the winter on hay, pastured the next summer, and sold as yearlings to be fattened for slaughter.

It is not necessary to have grain for feed in feeder cattle production. The cow herd may be successfully maintained on pasture in summer and on hay during the winter; therefore, such a program is well adapted to land areas not suitable for rotation crops—lands that are rolling and subject to erosion when cultivated or areas too dry for crops other than grass. Land in timber or bottom land too wet for crop production often makes a good grazing area.

Cattle can grow and produce on rations containing mostly roughages. This ability in cattle makes it possible to develop a profitable business on what may otherwise have been waste land.

The western rancher is probably the most typical of the producers of feeder cattle. Thousands of acres of semi-arid lands are

producing high-quality feeders, most of which are shipped into the Corn Belt for fattening. It is also true that the Corn Belt proper has much hilly land that can produce grass which may eventually be marketed as beef. Land not capable of raising high yields of crops can often be converted to grass, making more profit for the owner.

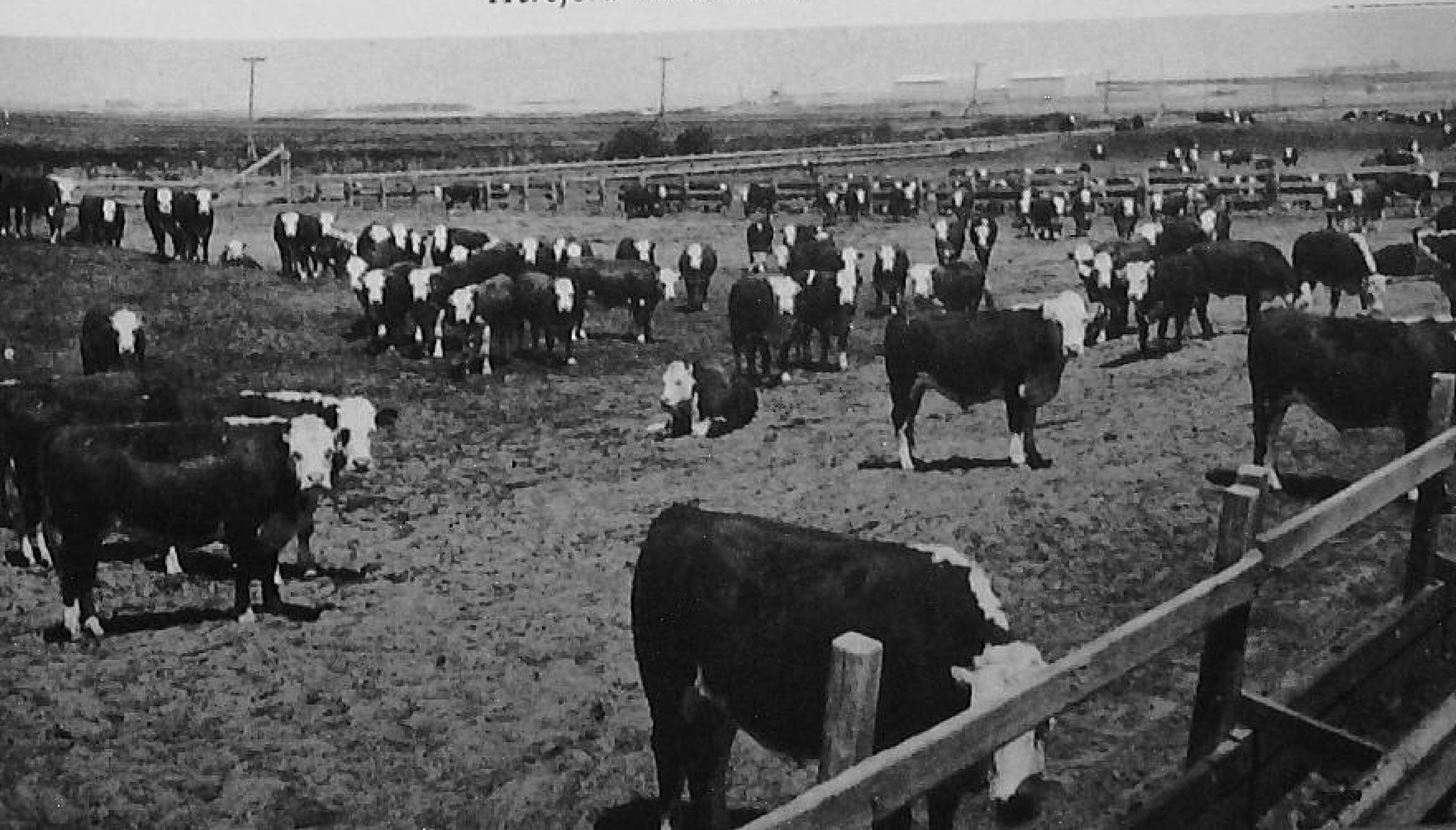
Many young farmers with capital too limited to purchase high-priced crop land may find opportunities in the purchase of low-priced grass land which can be used in the production of feeder cattle. Successful feeder cattle production depends largely upon having a good supply of cheap forage crops available.

Production of Fat or Slaughter Cattle. Farmers who make a business of buying feeder cattle and fattening them for market are called "cattle feeders." Most cattle feeders buy range cattle in the fall. The fall corresponds to the end of the grass season and the harvest of grain crops. The rancher generally wants to sell his feeders before snow covers the grass, and the cattle feeder is interested in buying after harvest when he knows how much grain he has to feed.

Since grain is usually essential in finishing high-quality beef, most cattle feeders are located in a feed grain area.

Profits from fattening cattle come from two sources: (1) the selling price over purchase price, which is known as *margin*, and (2) the value of the increased weight over the cost of the feed. If a feeder buys cattle weighing 700 pounds at $18 per hundred-

FIGURE 89. *Western-produced cattle in a Midwest feed lot.* (Courtesy American Hereford Association.)



weight and sells them after fattening for $20 per hundredweight, he has made a margin of $2 on each 100 pounds of original weight, or a total margin of $14 per head. If the cost of the feed and other expenses of the feeding operation amounts to $17 per 100 pounds of gain, then the feeder has made a profit of $3 per 100 pounds of gain. If he increases the weight of these cattle to 1100 pounds, which represents a gain of 400 pounds per animal, his profit on gain is $12. His marginal profit is $14, giving a total profit of $26 per head.

The principal reasons cattle feeders have for buying and fattening cattle are: (1) to receive a higher price for their grain when sold as beef, and (2) to increase soil fertility by spreading the manure on the land. If the manure is properly handled, a large part of the plant food removed by the crops may be returned to the soil. Farms that have had a cattle-feeding program over a period of years are generally high in fertility.

The Purebred Beef Cattle Industry. The breeder of purebreds produces high-quality bulls and cows to improve the breed and to provide bulls for use by the producers of feeder cattle. He maintains a pedigreed herd of breeding stock. He sells to feeder cattle producers and to other breeders. Quality purebred animals usually bring premium prices. Commercial cattlemen turn to the breeder for bulls, and occasionally for females, for use in improving their herds. The breeder of purebreds can rightfully claim most of the credit for the improvement of the beef cattle breeds.

More skill, knowledge, and patience are probably required for success in the purebred business than in any other phase of beef production. The breeder of purebreds must know the type of

FIGURE 90. *Part of an excellent purebred herd. (Abernathy photo. Courtesy American Aberdeen-Angus Breeders' Association.)*

cattle that are in demand. He must keep in mind the kind that will make the most money for the producer and the feeder, and the type that will cut a carcass to suit the consumer. Producers and feeders desire rapid-growing and fattening cattle, whereas consumers want a tender, flavorful kind of beef with a uniform distribution of fat. The breeder must understand all these problems and select and mate animals that will produce the desired kind of meat. The breeder must have complete knowledge of cattle nutrition because proper feeding is important in developing breeding animals.

More capital is needed per animal for purebred production than for any other phase of the beef cattle business. Foundation stock is usually high in price and equipment needs per animal are greater than for feeder or slaughter cattle production. Improvement is slow, and it may be many years before a herd of quality animals is developed. Before the breeder can reap substantial returns for his effort he must have both quality and quantity of animals to sell. Although it is not essential, experience in growing and fattening commercial cattle may be helpful before attempting to develop a purbred herd.

Large amounts of grain are not essential in purebred production. Bulls and females that are being fitted for shows probably need grain in order to produce the finish necessary to bring out the type and quality of the animal. Animals carrying a good finish are usually more attractive to prospective buyers; therefore some fattening grains may be desirable.

Combining Two or More Enterprises. Under certain circumstances two or more beef enterprises may be combined profitably. An example might be the program on a half-section farm with 160 acres of land capable of producing good grass, but too hilly for rotation cropping; the other quarter-section may be level rich land, in rotation crops. If the fertility of the tillable land is to remain high, from 20 to 40 acres will probably be seeded in rotation to a legume and grass crop and 20 to 40 acres to oats—leaving from 80 to 120 acres for corn. A herd of stock cows may be kept to consume the pasture and part of the hay, but there will not be enough corn to feed out the calf crop. Some of the calves may be sold as feeders and the remainder placed in the feed lot and fattened. Many such programs have been successfully developed on Midwest farms. A purebred herd may be developed in combination

with a fattening or range program. Many times the commercial cattle program can be depended upon to furnish a living and to provide capital until the purebred herd is established.

SUMMARY

There are three major divisions of the beef cattle industry:

1. Production of feeders.
2. Production of fat or slaughter cattle.
3. Purebred beef cattle industry.

Lands which are not suitable to rotation crops but which will produce grass are best adapted to feeder cattle production. Feeders are generally sold to Corn Belt or grain-producing farmers where they are fattened for slaughter. The farmer who fattens cattle depends upon the difference in the price of beef over feed and operating costs, or the difference in the buying and selling price (margin) for his profit.

The breeder is responsible for furnishing improved stock for commercial cattlemen and for other breeders. Breeders of purebreds generally need a higher capital outlay per animal than do ranchers or cattle feeders. Breeders require considerable knowledge of type and mating if they are successful. Income from purebred herds may be high because quality animals usually bring premium prices. Farms producing a combination of grain and grass in quantity may be suited to two or more beef enterprises.

QUESTIONS

1. Which beef cattle enterprise is best adapted to your farm? Why?
2. What type of land or farm is best suited for developing each of the three types of beef cattle enterprises? Why?
3. Give an example of how two beef enterprises could be combined successfully on one farm.
4. Why is more knowledge and skill required for success in breeding beef cattle than in the other beef production programs?
5. Which program requires the most capital per animal? Why?
6. What determines the profit in each type of the beef production enterprises?

REFERENCES

Juergenson, Elwood M., *Approved Practices in Beef Cattle Production*, The Interstate Printers and Publishers, Danville, Illinois, 1951.

National Livestock Marketing Association, Chicago, Illinois. *Cattle Handbook*, 1935.

< 12 >

Selection of Breeding and Feeding Stock

Upon entering the beef cattle business one must decide which breed of cattle to produce. Breed is an important consideration for the person producing purebred animals or feeder cattle. The cattle feeder is usually less concerned about breed because his animals go directly to the packer for slaughter, and he is then in the market for another bunch of feeder cattle. Anyone producing young animals for either breeding purposes or the feed lot is generally considered a breeder.

SELECTING THE BREED

The breeder has many decisions to make before he selects a breed of cattle. It generally takes a long time to establish a herd of high-quality animals. To change breeds, once a start has been made, means a delay in reaching his goal.

Careful consideration should be given the following before a start is made on a cattle breeding program of either purebred or grade animals: (1) personal likes, (2) availability of breeding stock, (3) outlet for surplus animals, and (4) environmental conditions under which the animals will be raised.

Personal Likes. Most cattle feeders develop a liking for certain breeds of livestock. Characteristics such as color, form, and general appearance have a personal appeal. One who likes the compact Black Angus may find it difficult to develop the same interest in Brahman cattle, which are so important in certain areas of the United States. Dollar value alone should not determine which breed of cattle one develops. Personal satisfaction and pleasure derived from the work is part of a satisfactory vocation. Unless other conditions make it inadvisable to select a breed of personal choice, one should give that factor due consideration before making a start in breeding cattle.

Availability of Breeding Stock. The cattle breeder must be continually on the lookout for animals he can bring into his herd for improvement. Other breeders of the same breed are his main source of supply. If they are few and far between in his particular area, the cattle breeder will have limited numbers to choose from, and he may have to travel over long distances to replace his animals, at greater cost.

Outlet for Surplus Animals. The breeder of purebreds depends upon other purebred and grade breeders for the sale of bulls and surplus females. The number of such breeders in his area contribute much to his sales. Unless there is a good market available for breeding stock, prices will be low and profits small. An Angus breeder in the center of a Shorthorn or Hereford area may have to ship his animals over long distances for a market outlet. Buyers will have to travel further to inspect his offering, thereby increasing the cost to the purchaser and decreasing the profits to the owner.

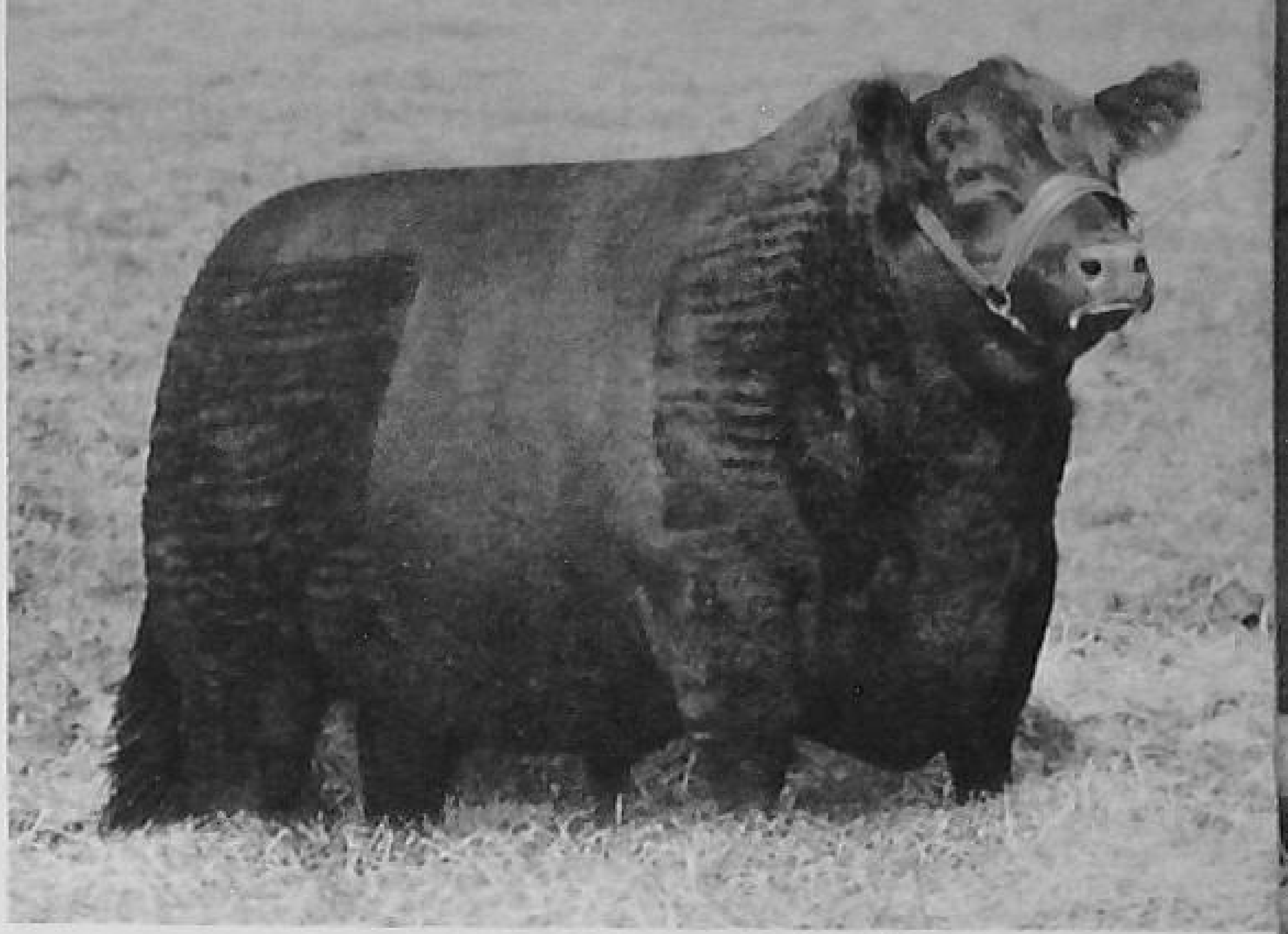
Grade herd producers generally find cattle feeders their best market. Although cattle feeders are less concerned about breed than are cattle breeders, certain areas tend to show partiality for certain breeds. If the commercial producer has a good market in a certain locality, he will be wise to give consideration to the breed most popular among feeders in that area.

Environmental Conditions. Weather, grazing, and disease conditions are important factors in selecting a breed of cattle. The Brahman cattle, for example, are able to make good use of poor forage, are not particularly bothered by flies, ticks, or mosquitoes, and are resistant to Texas fever, which makes them or their crosses especially valuable in certain southern areas. The Hereford is noted for hardiness and foraging ability where certain diseases and insects are not prevalent. The Shorthorn and Angus have special merits under certain circumstances. Cattle best adapted to the conditions under which they will be raised should be considered by the prospective producer.

BREEDS OF BEEF CATTLE

A purebred breed is a group of animals that have a common origin. They possess certain well-fixed characteristics, such as color, markings, horns, or polled character, which they are able to transmit to their offspring. A record of their ancestry, known

FIGURE 91. *Aberdeen-Angus bull. (Chandler photo. Courtesy American Aberdeen-Angus Breeders' Association.)*



as a *pedigree*, has been kept. Grade animals are those animals which possess most of the general characteristics of the purebreds but do not have a pedigree or ancestry record.

The breeds of beef cattle found in the United States are: Aberdeen-Angus, Brahman, Hereford, Polled Hereford, Shorthorn, Polled Shorthorn, Galloway, and Santa Gertrudis.

Aberdeen-Angus. According to the best historical evidence available, the Aberdeen-Angus cattle originated in northern Scotland. The first importations of these Scottish cattle were made into the United States in 1873 by George Grant, a native of Scotland then living in Victoria, Kansas. Many more importations were made during the latter part of the nineteenth century and have continued up to the present time. However, as the breed became well established in America, importations gradually declined. Today most of the great sires of the breed in the United States were produced in this country.

The Aberdeen-Angus cattle are black. White is objectionable, except on the underline behind the navel and there only to a moderate extent. The breed is polled (no horns), which has con-

FIGURE 92. *Aberdeen-Angus cow. (Abernathy photo. Courtesy American Aberdeen-Angus Breeders' Association.)*

FIGURE 93. *Brahman bull. (Hereford Photos, Inc. Courtesy American Brahman Breeders Association.)*

tributed to Angus popularity among many breeders. The polled characteristic in Angus cattle is so well established that when Angus are crossbred with horned breeds most of the first cross offspring are polled. Angus cattle have shown more resistance to certain eye diseases, particularly to cancer eye and pinkeye, than have some of the other breeds. Calves from Angus cows are usually smaller at birth than are those from other breeds, but the weaning weight is equal to, or in many instances greater than, that of other breeds. The smaller calves at birth cut down calving difficulties, and there are fewer cow and calf losses at this period.

The body form of Angus cattle is smooth, broad, low set, blocky, compact, and well muscled. No other breed has gained a better reputation as a show ring winner and carcass winner than the Angus.

Brahman Cattle. The Brahman, the oldest existing domestic cattle, are native to India. The first cattle of this breed to play a part in the development of Brahman cattle in this country were two bulls given to Richard Barrow of Louisiana in 1854. These bulls were a gift of the British Crown in recognition of Mr. Barrow's services in teaching sugar-cane- and cotton-raising to a British representative. Although Brahman cattle had reached this country in 1849, it is believed that the purebred animals were wiped out by the War Between the States.

The use of Brahman cattle for purebreeding and crossbreeding in the United States was given considerable emphasis when two Texas ranchers, J. M. Frost and Albert Montgomery, bought some

FIGURE 94. *Brahman female. (Cavanaugh photo. Courtesy American Brahman Breeders Association.)*

crossbreeds from Mr. Barrow and later imported two bulls from India. In recent years considerable interest has been shown in the development of Brahman cattle in the South. A number of Brahman crossbred feeder cattle have reached Midwest feed lots and have given good results as fattening cattle.

Brahman cattle are characterized by the large hump over the shoulders and loose skin in the area of the dewlap. They have drooping ears, and instead of the "moo" of other cattle they produce a sound resembling a grunt. The most prevalent color is various shades of grey, although red is very acceptable.

In form the Brahman cattle are more upstanding, less compact, and lack the smoothness of the other breeds.

Brahman cattle are resistant to Texas fever, can stand heat well, and are bothered little by flies, ticks, and mosquitoes. They are able to produce beef when grazing on poor-quality forage on which other breeds would fail. These characteristics have made Brahman and crossbred strains, developed by using Brahman on Hereford, Angus, and Shorthorn, very popular in areas of the southern part of the United States. These crossbred calves have produced gains and carcass quality equal to any of the other breeds. Like the Angus they show resistance to cancer eye and pinkeye.

Herefords. Hereford cattle are native to England. The first breeding herd of Herefords to play an important part in establishing the breed in the United States was that of William H. Sotham and Erastus Corning of Albany, New York, in 1840. There is,

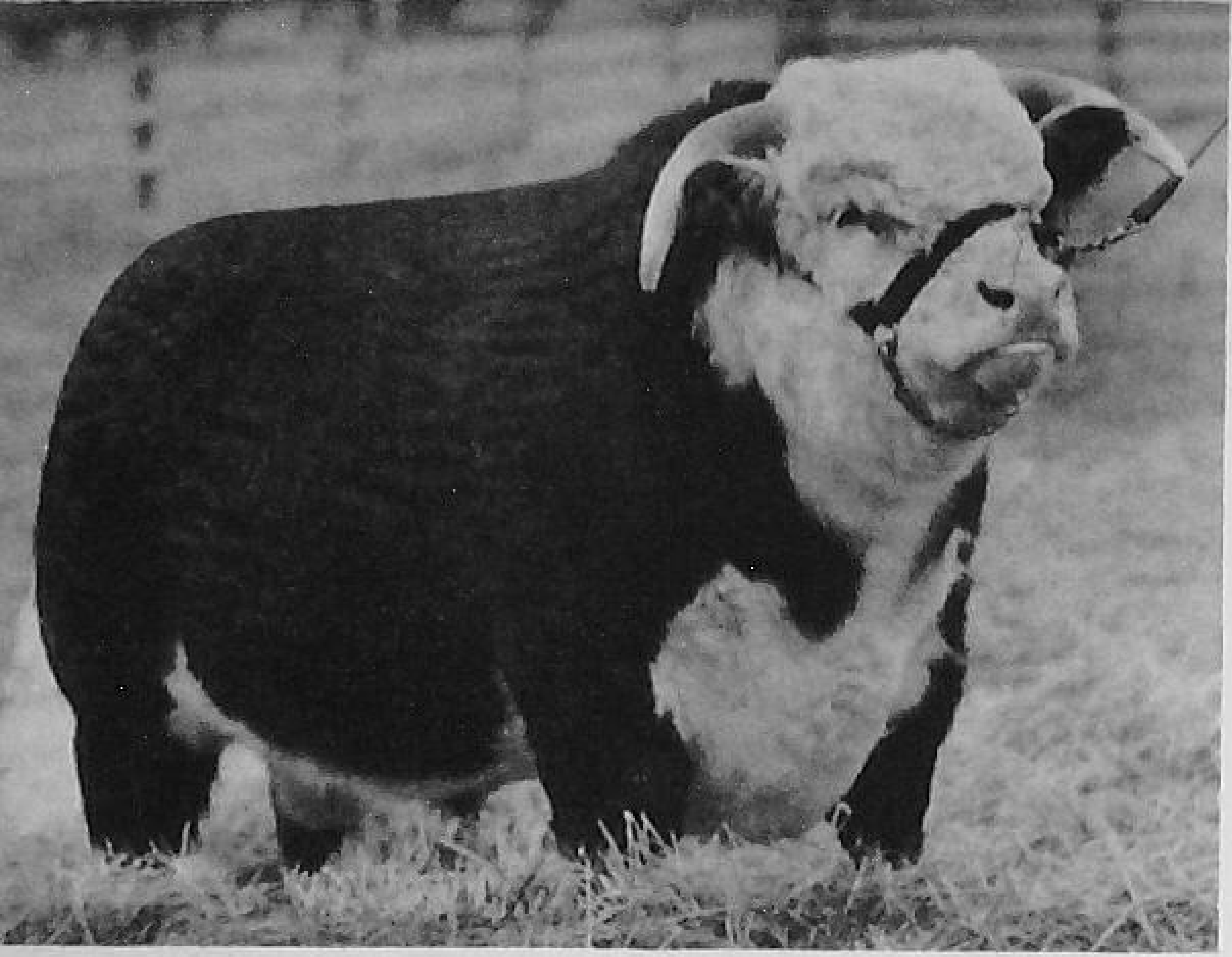


FIGURE 95. *Hereford bull. (Hereford Photos, Inc. Courtesy American Hereford Association.)*

however, a record of Hereford importations into this country as early as 1817. The Hereford breed grew rapidly in the United States. Today there are more Herefords than any other breed in the United States. The breed is popular from coast to coast and is found in large numbers in every state.

Hereford cattle are easily distinguished by their red-colored bodies and white faces. The accepted color is a rich red with white face. The white is found on the flank, underline, breast, crest, tail switch, and below the hock and knees on both fore and hind legs. They are often referred to as "white-faced cattle."

In form Hereford cattle are low set, muscular, compact, broad, and smooth. They are well developed in the regions of the valuable cuts—the back, loin, and hind quarters, or round.

The Hereford breed is well known for its vigor and foraging ability. These characteristics have made them popular with ranchers and feeders. Herefords out-number all other breeds on the ranches of the West and Southwest.

Polled Hereford. In 1900 Warren Gammon of Iowa wrote to

FIGURE 96. *Hereford female. (Hereford Photos, Inc. Courtesy American Hereford Association.)*

FIGURE 97. *Polled Hereford bull. (Hereford Photos, Inc. Courtesy* Polled Hereford World.)

nearly every breeder of Herefords in the United States asking if they had any cattle which did not develop horns. He succeeded in securing thirteen head of purebred Herefords that were polled. From this small beginning the Polled Hereford breed was established.

In form and characteristics the Polled Herefords resemble their ancestors, the Herefords, the main distinguishing difference being the absence of horns.

The breed has become very popular among breeders who desire the Hereford form but dislike the horns. Many commercial or grade Hereford breeders buy polled bulls. When polled bulls are used on horned cows, a large percentage of the calf drop will be polled. Polled Herefords that originated from purebred Hereford stock may be registered in both breeds.

Shorthorns. The Shorthorns are native to England, and were given the name because early English breeders succeeded in shortening the horns of the long-horned cattle by a breeding process. The breed, introduced in 1783 by Miller and Gough of Vir-

FIGURE 98. *Polled Hereford female. (Hereford Photos, Inc. Courtesy* Polled Hereford World.)

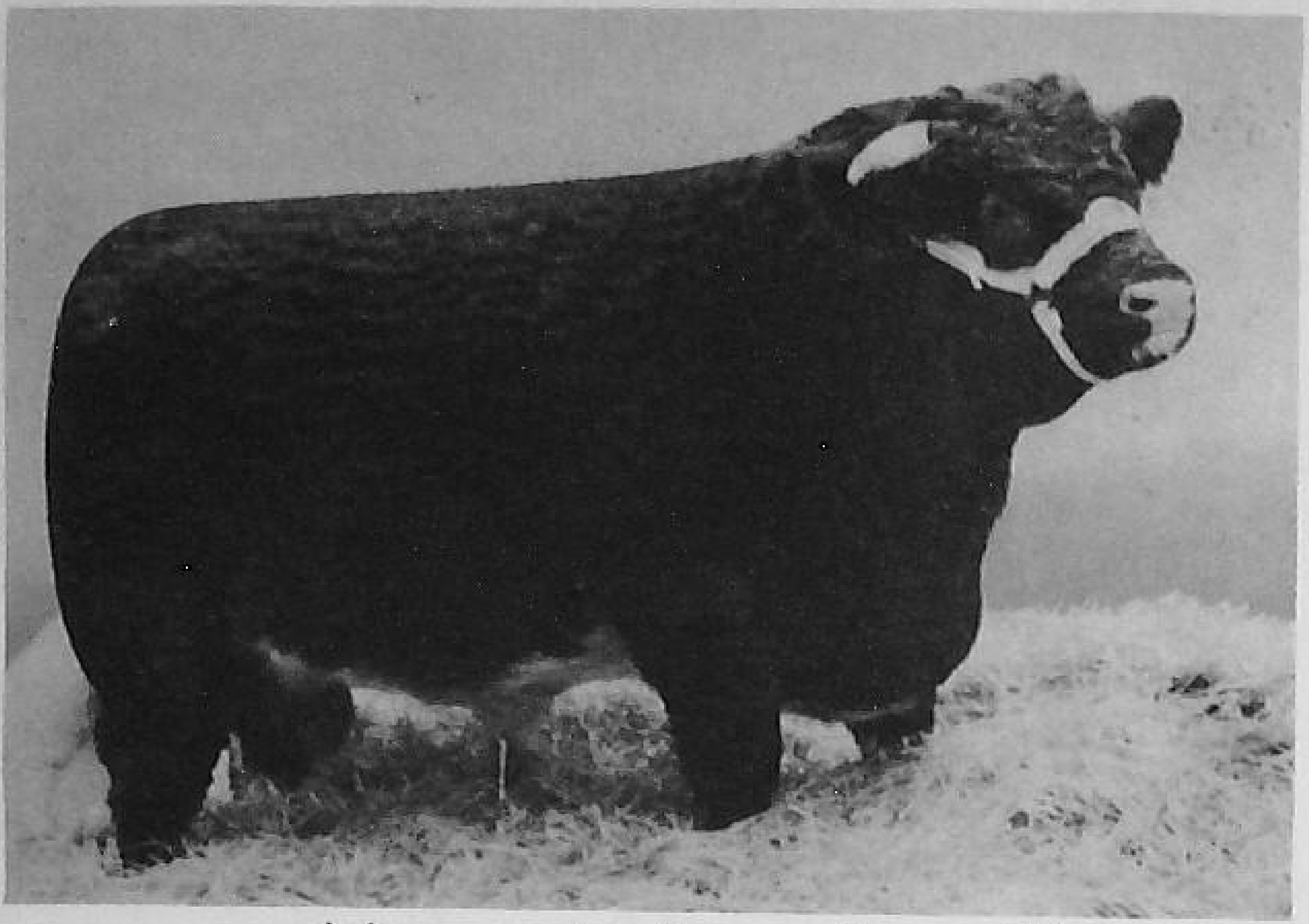


FIGURE 99. *Shorthorn bull. (Abernathy photo. Courtesy American Shorthorn Breeders' Association.)*

ginia, was the first to be established in America. These cattle gained rapidly in popularity, and are found throughout the United States today.

In form the Shorthorn is the largest of the beef cattle breeds. They are rectangular and compact. They range in color from red to white and all combinations of these colors, such as spotted or roan. The Shorthorn is the best milking breed of beef cattle, and many farmers who desire a good beef animal plus one that will give enough milk for home use have been attracted to the Shorthorn.

Polled Shorthorns. The Polled Shorthorns were developed by a cross and from naturally polled Shorthorns found in the breed. Most of the earlier animals were developed by crossing on polled cattle of another breed and were eligible to be registered only as Polled Shorthorns. Most present-day Polled Shorthorns are descendants of purebred Shorthorn cattle, and are known as *double standard* because they may be registered both as polled and standard Shorthorns.

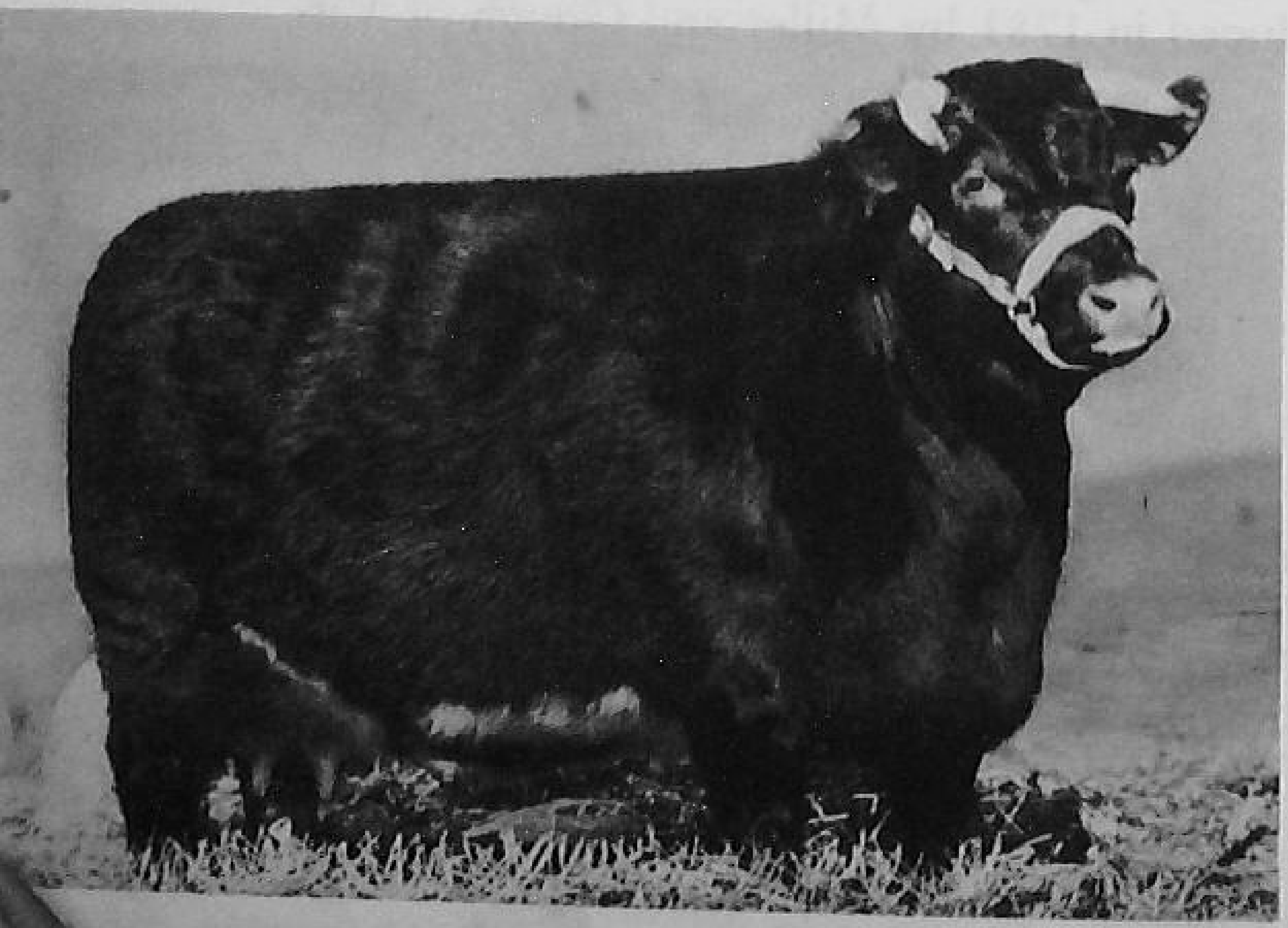


FIGURE 100. *Shorthorn female. (Abernathy photo. Courtesy American Shorthorn Breeders' Association.)*

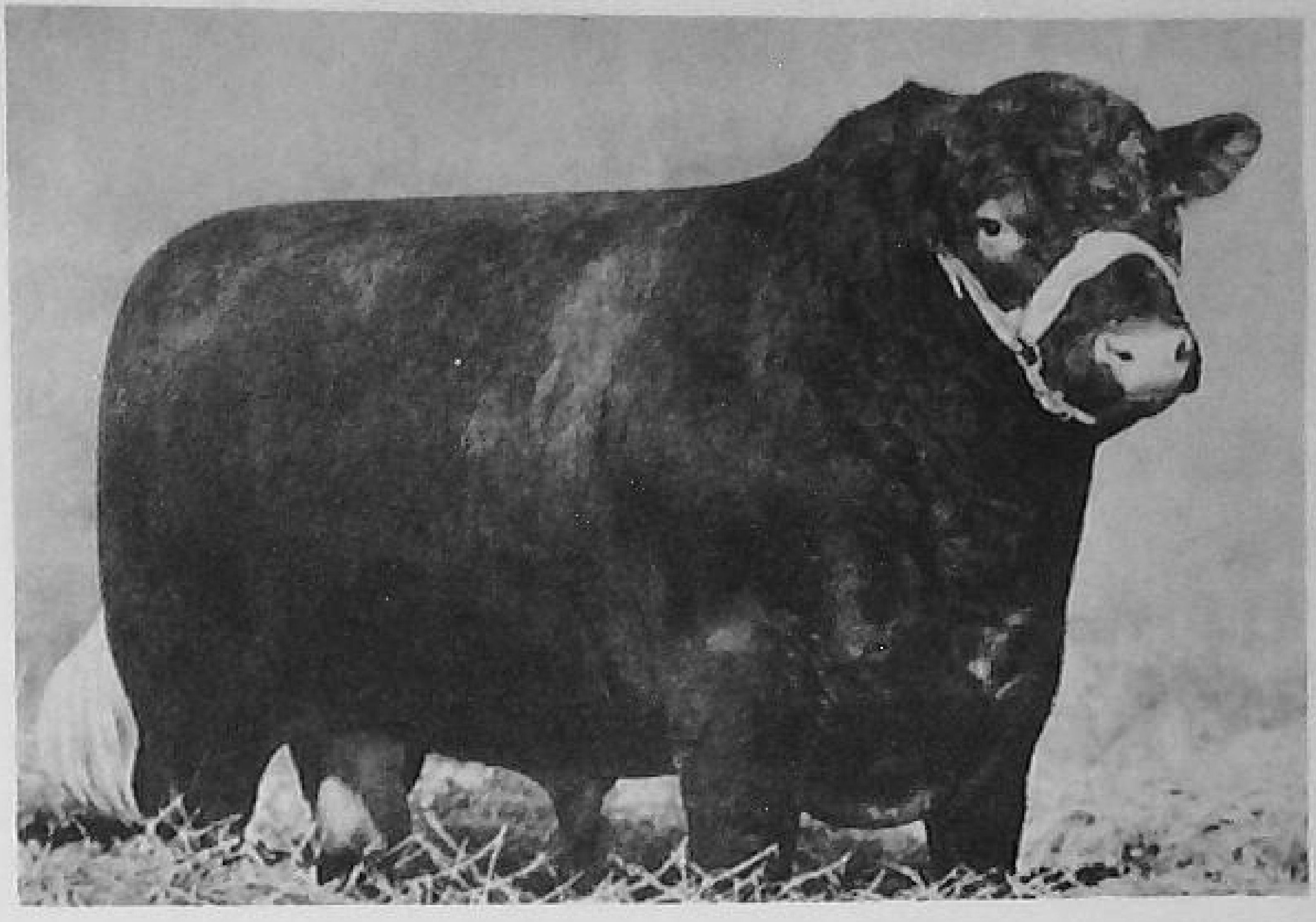


FIGURE 101. *Polled Shorthorn bull. (Abernathy photo. Courtesy American Shorthorn Breeders' Association.)*

In form and color the polled Shorthorns are similar to the Shorthorns except for the polled characteristic.

Galloway. The Galloway cattle are native to Scotland. They were probably introduced into the United States about 1860. For a period following their introduction they became popular through the North Central states.

They are good rustlers and extremely hardy, able to stand cold weather conditions. However, probably due to the slower development of the Galloway, the breed has steadily declined in the United States.

Galloway cattle are the smallest of the beef breeds. They are black in color with long curly hair. The Galloway are polled, have short legs, and are blocky and compact in type.

Santa Gertrudis. Several strains of cattle have been developed in the South by using Brahman crosses on other beef breeds. The most common of these strains has been the Santa Gertrudis developed by the King Ranch in Texas. Santa Gertrudis are three-

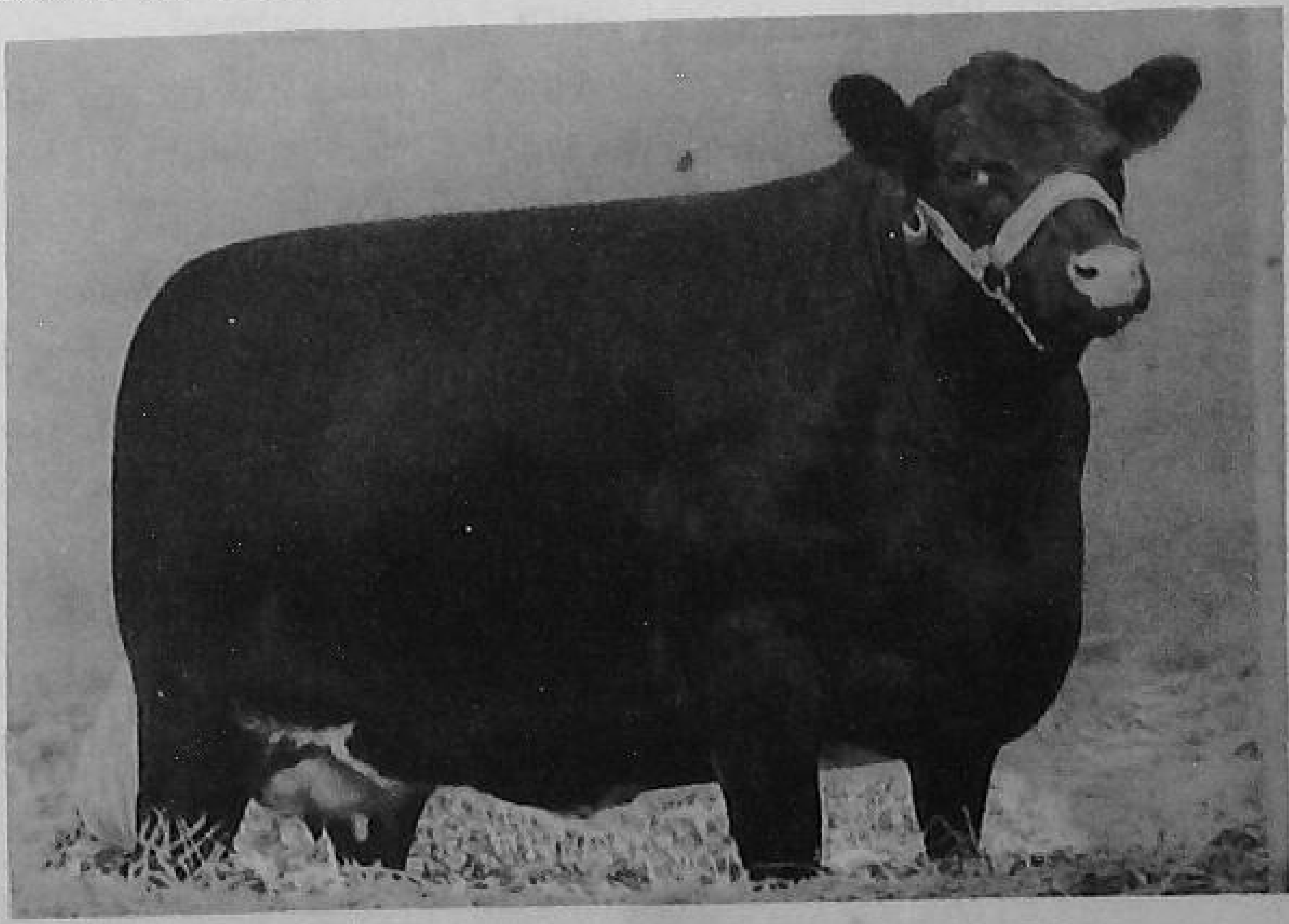


FIGURE 102. *Polled Shorthorn female. (Abernathy photo. Courtesy American Shorthorn Breeders' Association.)*

FIGURE 103. *Santa Gertrudis bull. Note the near absence of the hump which is characteristic of the Brahman. (Courtesy King Ranch, Kingsville, Texas.)*

eighths Brahman and five-eighths Shorthorn. The hump over the shoulders, characteristic of the Brahman, has been removed in the breeding process. The Shorthorn has improved the body conformation. The breed carries most of the heat and insect resistance of the Brahman and the ability to produce on comparatively poor forage.

Santa Gertrudis, although not as low-set, blocky, and compact as other beef breeds, do produce very good carcasses. They are thick, have deep bodies, and are wide in form. They have been selected for red color and are breeding very true to form. Although the breed is comparatively new, it is rapidly gaining in popularity in many Southern areas.

Crossbreds. For commercial cattle crossbreeding has shown some definite advantages over purebreeding. Experiments conducted by the University of Illinois on Hereford-Angus crossbreds showed fewer losses of crossbred calves at birth or as young calves than of the purebreds of the corresponding breeds. The crossbred calves out-gained the purebred calves from birth to weaning. In the feed-lot test, the crossbred calves made more efficient gains than did the Angus, but the purebred Herefords were more efficient than the crossbreds. Crossbreds from the Angus cows sired by a Hereford bull yielded the highest grading carcasses.

Brahman crosses on Hereford, Shorthorn, and Angus cattle improved the carcass quality over the purebred Brahman while retaining much of the heat and insect pest resistance of the Brahman. The crossbred Brahman has shown more ability to graze and produce beef on low-quality forage than have the standard American breeds. Much of the Brahman's resistance to Texas fever, so prevalent in certain Southern areas, has been retained in the crosses.

Experimental work of the U. S. Department of Agriculture has shown that a rotation system of crossing three breeds results in somewhat heavier calves at weaning time and faster feed-lot gains.

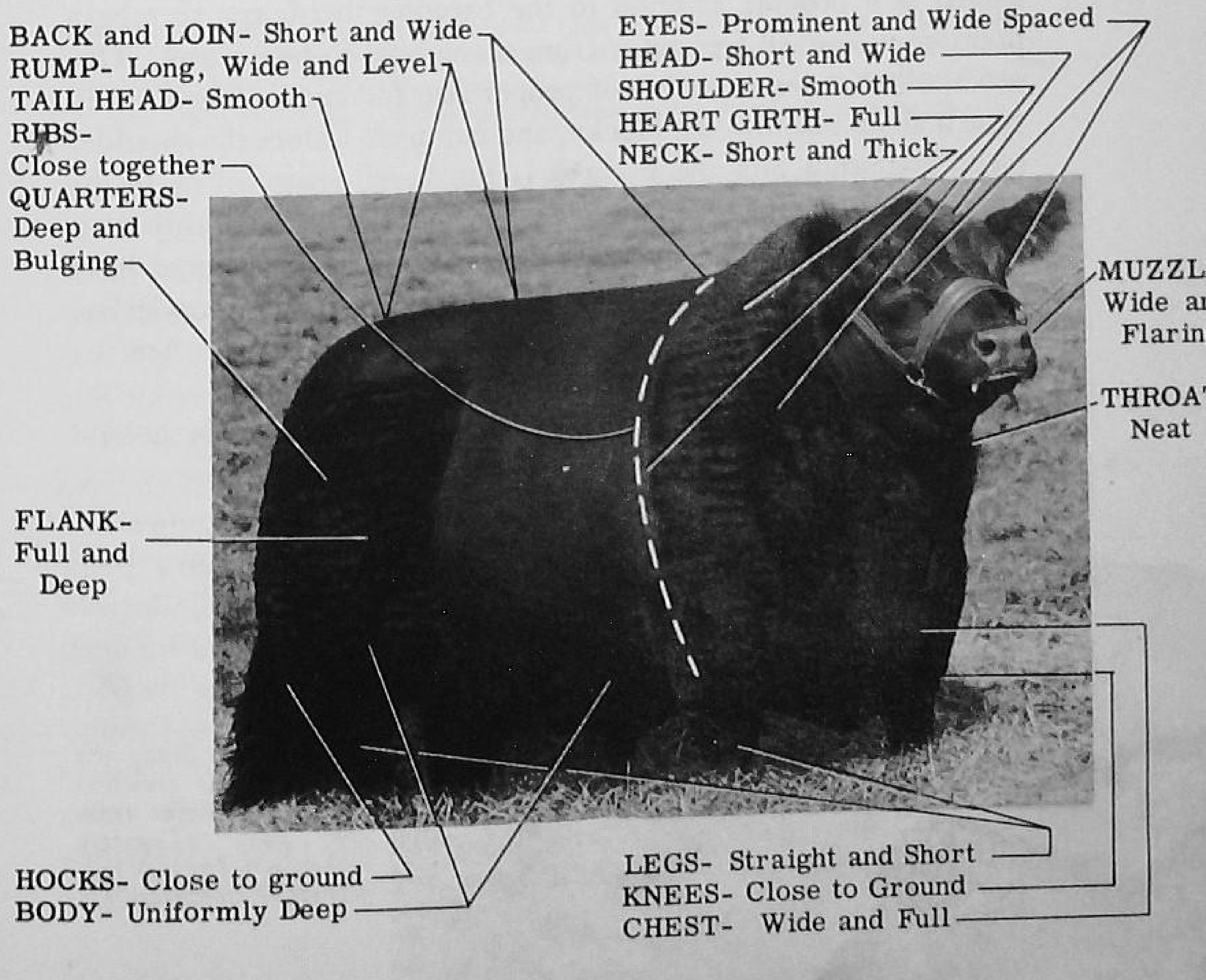
The use of a naturally polled breed, such as the Angus, when crossing with a horned breed results in most of the first-cross calves being polled. This saves the time and cost of the dehorning operation.

There are also disadvantages to be considered when crossing cattle. Crossbreeds usually are of mixed color and lack the uniformity in type of straight-bred cattle. Uniformity in color, type, and size adds to the appearance of a group, and uniform cattle generally sell better, especially if sold as feeders.

SELECTING FOUNDATION STOCK

After having decided upon the breed, the problem of selecting individual animals for foundation stock must be considered. Good

FIGURE 104. *By studying this figure you can learn the names of the parts of cattle and what to look for in selection of animals. (Chandler photo.)*



and inferior animals exist in all breeds. Regardless of the breed, certain general characteristics that contribute to beef production should be understood and used as a basis of selection. The breeder of purebreds will be concerned with breed characteristics which animals must have if they are to be eligible for registration.

Some features that would disqualify animals from being recorded as purebreds are: A Hereford having horns or horn spurs could not be recorded in the Polled Hereford herd book; an Angus having white any place except on the underline near the navel could not be registered as a purebred Angus. There are many other disqualifications, too numerous to mention in this book, that a prospective breeder should become familiar with. This information can be secured from the breed associations.

The producer of grade animals is usually less concerned about breed disqualification, but like the purebred breeder, should carefully consider those factors that contribute to economical beef production.

Selection Based on Body Conformation. When considering an animal as a possible addition to the breeding herd, try to take a position at least 10 feet away from the animal to be judged. Observe whether the animal is of proper size for age and breed. In type it should be low-set, blocky, and compact. Does the shoulder blend smoothly into the body? Is the heart girth full? Is the neck short and thick? Does the tail-head blend smoothly into the rump? Is the rump long and level? Does the animal have good depth with a well-sprung rib? Is the top and underline straight? Does the animal move freely and with style? Are the legs straight with medium-size bones?

After answering these questions, take a position directly behind

FIGURE 105. *Study the form of this excellent Aberdeen Angus from the side. (Courtesy Aberdeen-Angus Breeders' Association.)*

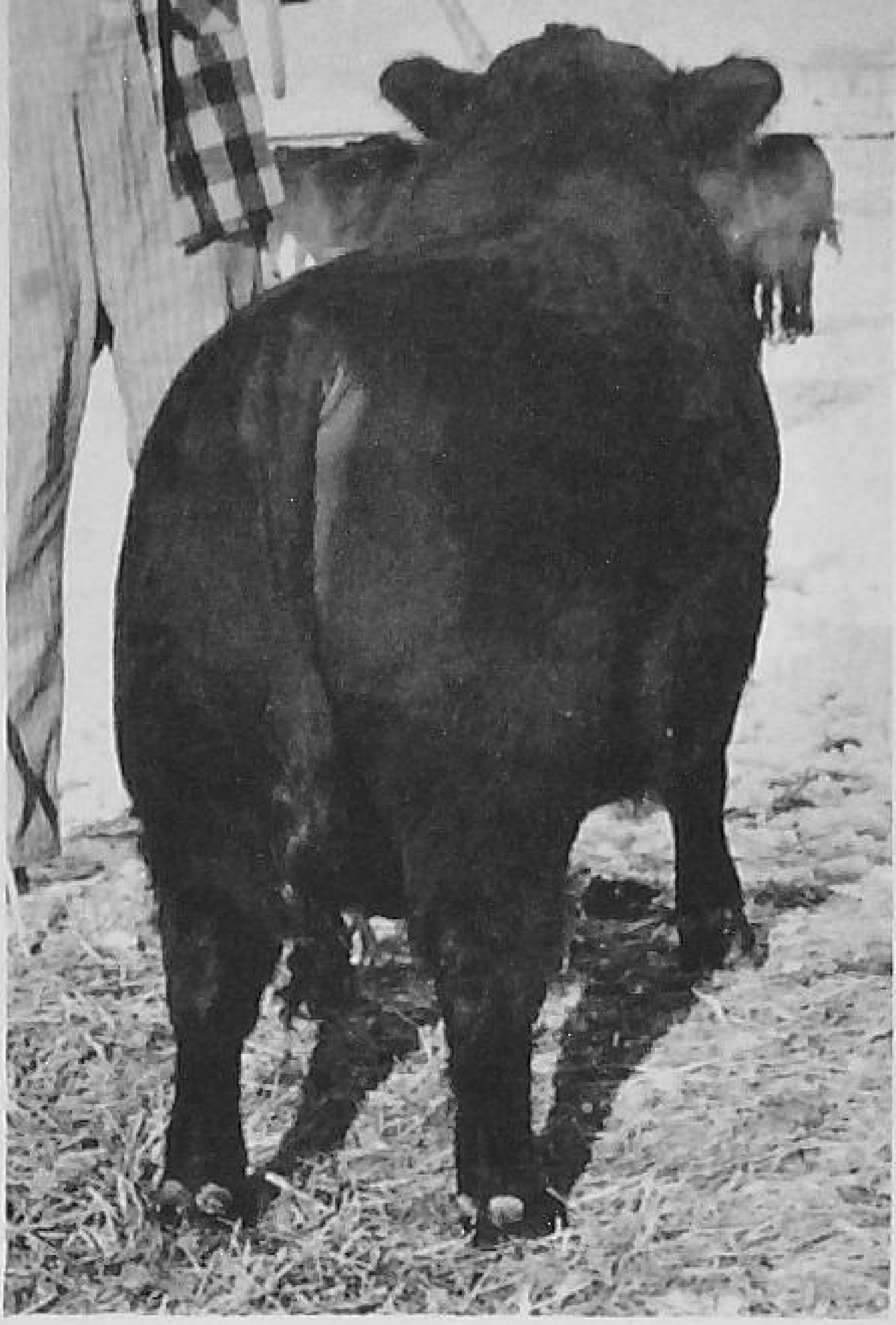


FIGURE 106. *(left) Here we see the rear view of a very good Angus. (Courtesy American Aberdeen-Angus Breeders' Association.)*
FIGURE 107. *(right) This view gives us an opportunity to study an ideal type animal from the front. (Courtesy Aberdeen-Angus Breeders' Association.)*

the animal. The hind quarters should be wide, plump, and well-developed in proportion to the rest of the animal. The thighs should be thick, carrying flesh down to the hocks. The twist should be deep, not cut up between the hind legs. In looking over the top of the animal, observe if it is broad over the back, loin, and rump.

Next move to a position in front of the animal. The desirable head is broad, slightly dished; the eyes should be wide-set, full, and expressive. The forelegs should be wide apart, allowing for good width on the chest floor. Bulls should possess pronounced masculinity. Females should show refinement and should give indication of being good producers.

Next, step close to the animal, keeping the hand flat, and feel down over the back, loin, and ribs. This procedure will tell the amount and uniformity of fleshing over the region of valuable cuts. Breeding cattle do not necessarily need exceptionally high condition unless they are to compete for premiums in the show ring. However, the covering should be uniform and free from

patches and lumps over the back and rump. Animals that carry good flesh, as compared to others being given the same feed, usually indicate easy keepers and are desirable breeding prospects. The hide should be pliable and of medium thickness, and the hair fine and soft.

Remember there is no perfect animal, but after carefully considering all the points listed here, if the animal has scored well compared to the average of the breed, then we may be sure the general type is satisfactory.

Selection Based on Production Records. In selecting breeding stock other factors in addition to the appearance of the animal must be considered. Good production records are very important, and some of the more progressive breeders are keeping and using records both for selection of replacement stock from their own herds and as an aid to prospective buyers. Breeders who are producing animals of the correct type and who can produce records showing good performance will command premium prices for their surplus animals. Production records should give the following information:

1. *Fertility record of the cows.* A 100 per cent calf crop is desired but seldom achieved. However, a cow herd that will produce a strong calf crop with few cows failing to breed indicates a high fertility rate bred into the herd. Since the profit lies in the calf crop, the fertility record of the herd and individuals in the herd is important in selection. Cows and bulls that are slow to breed and bulls that fail to settle most of the cows should be eliminated, and their offspring should not be kept as breeding animals.

2. *Weaning weight of calves.* If feeding and environmental conditions are uniform, calves that are the heaviest at weaning time indicate growth ability and good milking qualities of the mother. Many beef cows fail to provide enough milk for the rapid growth of the calf. It is also true that the ability of calves to make rapid gains is inherited, and strains within the breed vary considerably in their growth rate. The breeder who records the weaning weight, usually when the calves are six months of age, and uses it as an aid in breeding-stock selection will be developing a herd with fast growing ability. It must be remembered that weaning weights have little comparative value unless the entire calf crop has been on the same feed and under the same management. Feed is a major factor in growth rate. Calves receiving

liberal amounts of good forage and grain can be expected to gain more than those on poor rations, regardless of inherited growth factors.

3. *Rate of gain from weaning to market.* Probably one of the best tests of gaining ability of a breed or strain within a breed is the feed-lot performance. Representative animals from the herd may be put into the feed lot and the rate of gain and amount of feed required to produce 100 pounds of gain recorded. Such a test is especially well adapted for determining the ability of the bull to transmit fast growing and economical gaining qualities to his offspring.

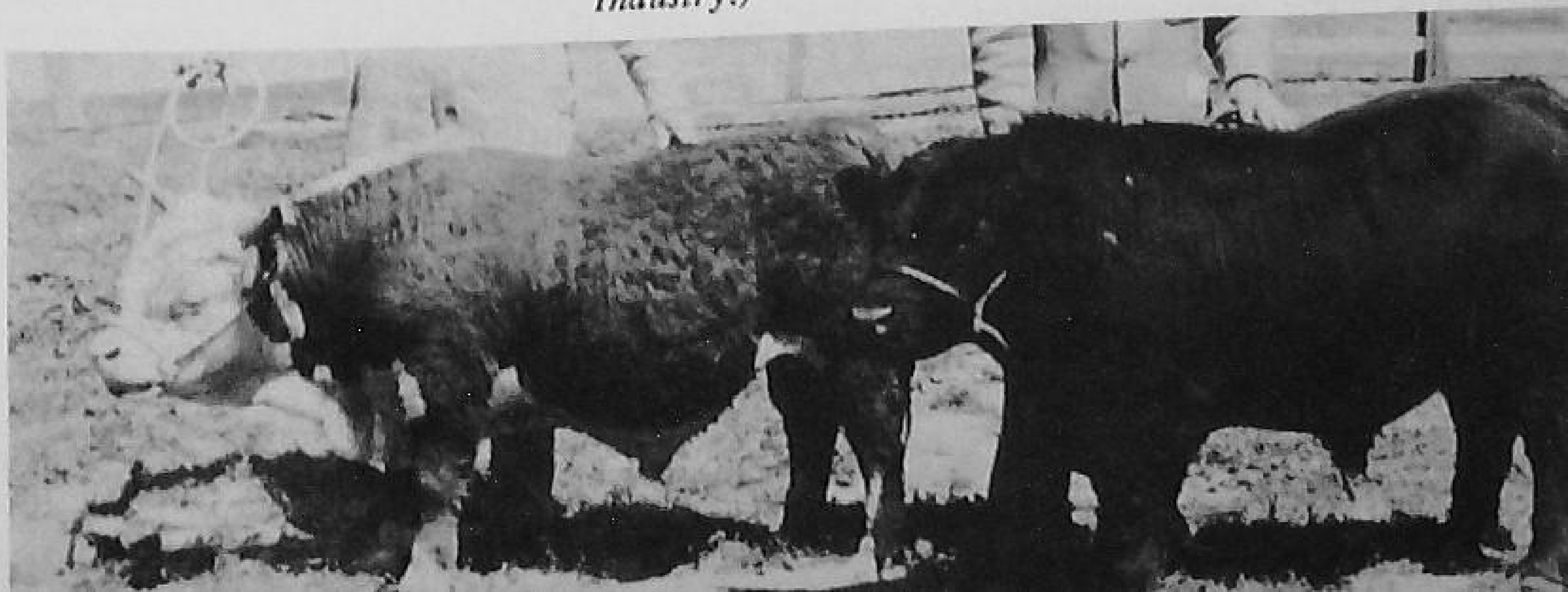
4. *Progeny testing.* A sire that has demonstrated his ability to transmit desirable qualities to his offspring, both in type and in gaining ability, is known as a *proven sire.* Such sires are few in number and very valuable as breeding animals. The best guarantee that animals will transmit desirable qualities to future offspring is their past performance. When the services of a proven sire cannot be secured, young animals sired by a proven bull are next best.

DEFORMITIES AND ABNORMALITIES

There are several types of deformities that may occur in cattle. Most of them are rare and do not cause a large economic loss. However, dwarfism or a condition that causes cows to produce midgets or dwarf offspring has appeared so often in beef cattle herds throughout the United States that special consideration will be given the subject.

Dwarfs are usually compact and blocky but very much undersized. They generally develop a large stomach and heavy shoulders. Later they may become sway-backed and develop crooked legs. Dwarfs represent almost 100 per cent loss economically.

FIGURE 108. *Typical dwarf cattle. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



Cause of Dwarfs. The condition leading to dwarfism is inherited. The parents may be perfectly normal but, when mated, may produce a dwarf. The problem is to determine which animals in the herd are dwarf carriers. When a bull, normal in appearance but a dwarf carrier, is mated to a similar cow, on the average one calf in four will be a dwarf. Of the remaining three calves, two will be carriers of the dwarf factor but will appear normal. As an example of how great the loss would be, let us suppose that in a herd of sixteen cows eight were dwarf carriers. If they were mated to a similar bull, one could expect two dwarf calves per year. Of the remaining six, two would carry the factor and, if kept in the herd, might produce more dwarf calves. To produce dwarf calves both parents must be carriers of the dwarf factor.

Prevention of Dwarfism. To purge the herd of dwarfs is not simple. If a dwarf results from any mating, both parents carry the factor, and they should be eliminated. This does not tell us how many more cows may be carriers. The ratio of dwarf calves from parents that are carriers is one in four. This is only a ratio based on large numbers, and it is conceivable that a carrier cow mated to a carrier bull for ten years may never produce a dwarf.

After having disposed of the carrier bull, one is confronted with the problem of securing a replacement that is not a carrier. If the prospective bull has been in service and has not sired any dwarfs, that is some indication he may be free of the factor. If replacement animals are selected from a herd where the record has shown no dwarfism, we have some assurance they do not carry the factor.

At the present time animal scientists are busy trying to perfect methods whereby dwarf carriers may be detected before going into service and contaminating cattle herds. Prospects of new discoveries in detection methods are very promising, but it is too early to come to any definite conclusions.

FEEDER CATTLE

Feeder cattle are cattle that are unfinished or those that do not carry enough condition to make the slaughter grade they are capable of. Such cattle are usually purchased from the range by cattle feeders and put into the feed lot to be fattened.

Classes and Grades of Feeder Cattle. Feeder cattle are classified and graded according to age, sex, weight, and conformation.

FIGURE 109. *Choice feeder cattle ready for shipment. (Courtesy American Hereford Association.)*

Age. Cattle are classified according to age as calves, yearlings, 2-year-olds, cows, bulls, and stags. All cattle are designated as *calves* until they are one year old. Between the ages of one year and two years they are classed as *yearlings*. Animals over a year but less than eighteen months old are sometimes referred to as *short-yearling*, whereas the term *long-yearling* is applied to animals over eighteen months but under two years of age. *Two-year-olds* are cattle between the ages of two and three years. Cattle three or more years of age seldom enter the feeder cattle trade, except for cows, bulls, and stags. Conditions under which cows, bulls, and stags may enter the feeder trade will be discussed later.

Sex. A *steer* is a male animal that was castrated at an early age and before he reached sexual maturity.

A *heifer* is a female animal that has not developed the mature form of the cow and has not had a calf. Usually females under three years of age are classed as heifers. *Heiferettes* is a term often used in the cattle trade. It refers to young cows, usually those that have not had more than one calf.

A *cow* is a mature female that has had one or more calves. A barren female (one that fails to get with calf) that has reached maturity is also classed as a cow.

A *bull* is an uncastrated male of any age.

A *stag* is a male animal castrated after he has developed the physical characteristics of a mature bull.

Weight. Steer and heifer groups of feeder cattle are classified as heavy, medium, and light on a weight basis. There is no weight

classification for cows, bulls, and stags.

Grades. Market grades of feeder cattle are not too well standardized and vary, depending upon the market. The generally accepted grades are fancy, choice, good, medium, common, and inferior. It is an impossible task to give a description of cattle grades that would be understandable to the inexperienced cattleman. Such knowledge can come only by association with cattlemen and observation of the grading process used by experienced operators. However, *fancy* feeders of any weight group are exceptionally compact, smooth, and blocky. They are well developed in the regions of valuable cuts and usually carry more finish than is expected on most feeder cattle. Feeders who are buying animals to be finished for the fairs and shows are looking for this kind of cattle. The price is generally too high to interest the average cattle feeder.

Choice cattle are very acceptable from a type and conformation standpoint. If properly handled, they can be expected to develop into a top slaughter grade. The rest of the grades are progressively poorer from a conformation standpoint, with inferiors at the bottom of the grade list. *Inferiors* very often carry a high percentage of dairy cattle breeding, which makes them undesirable from a beef standpoint. They are usually thin and cannot be expected to grade any higher than utility slaughter cattle, even when well fed. The following table summarizes the classes and grades of feeder cattle.

TABLE 14

CLASSES AND GRADES OF FEEDER CATTLE

	Sex	*Age*	*Weight*	*Grade*
FEEDERS	Steers	Calves Yearlings 2-year-olds	Heavy Medium Light	Fancy, choice, good, medium, common, and inferior.
	Heifers	Calves Yearlings 2-year-olds	Heavy Medium Light	Fancy, choice, good, medium, common, and inferior.
	Cows Bulls Stags	All ages All ages All ages	Any Weight	Choice, good, medium, common, and inferior

Cows, bulls, and stags do not make up a large percentage of the feeder cattle trade. However, when cows become old or nonpro-

ductive, they go to market. Some cattle feeders make a practice of buying cows. They fatten them to improve the slaughter grade, thereby increasing the per pound value. The profit on cows usually comes from margin because cows are not very efficient users of feed.

Bulls usually come to the market as singles, and are sold by breeders and commercial producers when they can no longer use them for breeding. A certain percentage of the bulls are castrated, fattened, and sold as stags.

Selecting Feeder Cattle. Feeding programs vary widely. There is a wide choice in weights, grades, ages, and kinds of cattle available to feeders. There is just as great a variation in feeding conditions. The kind of cattle to buy depends upon so many factors that only a few can be considered here. However, the more important considerations are: (1) kind and amount of feed available; (2) price of feed; (3) spread in prices between feeder and slaughter cattle; (4) future market outlook; and (5) the length of time they are to be fed.

Feed. If high-quality slaughter beef is to be produced, the use of liberal amounts of feed grains and good-quality forage is usually essential. A cattle feeder with his bins full of feed grains and a barn full of good hay may well consider buying choice grades. Since young beef grading prime generally tops the market, choice heavy calves or choice light yearlings which can be marketed at from 1000 to 1200 pounds in weight should be considered.

These cattle may be either steers or heifers. If heifers are purchased, the price must be less than that of steers in the same grade. Heifers gain somewhat slower on the average than steers, and will not equal steers in dressing percentage. The market price of fat heifers is usually lower than that of steers in the corresponding grade.

It takes both quality cattle and quality feed to produce top beef. Low-grade feeders, regardless of how well fed, will not make high-grade slaughter cattle. If there is an abundance of low-quality roughage, such as corn fodder, sorgo fodder, and hay that is coarse or stemy, available, the problem of using this forage profitably may be solved by feeding it to cattle. Cattle may be bought in the fall and used to clean up a corn field behind the picker or run out on the pastures as long as there is sufficient feed. Medium-to-

heavy yearlings, weighing from 600 to 750 pounds, and medium-to-common grades would be well suited for this purpose. After the rough feed in the fields has been eaten up, the cattle may be put in the feed lot and full-fed roughage with enough protein to meet the animals need. Grain should be limited to from 3 to 5 pounds per day until the last thirty to sixty days of the feeding period. A full feed of grain may be used the last month or so. These cattle will market as commercial-to-good slaughter steers and will not require more than 15 to 25 bushels of grain.

It is important that lower grade cattle be bought at a price considerably under the price of choice grades. Such cattle will not make top-grade slaughter animals, and the cattle feeder will receive less for them on a hundredweight basis. They do offer an opportunity to convert low-quality feed into a marketable product. High-grade cattle fed on low-quality feed will generally not produce the highest grade beef. The loss in margin usually results in a financial loss when cattle are not fed according to grade. The kind of feed available should determine to a large extent the grade of cattle to buy.

Feed prices. When prices of feed are high in proportion to finished beef and when feeder prices are low, the cattle feeder generally expects to make his profit on the margin rather than on the gain in weight. Under these conditions heavy cattle weighing from 800 to 1000 pounds may be the best. These cattle will be ready for market after a gain of from 200 to 300 pounds. The purpose of the gain is to finish the cattle to meet the requirements of their slaughter grade and to bring the feeder an increased price per hundred over the cost of the feeders. If he makes a marginal profit of from $2 to $3 per hundredweight, he has a profit of from $16 to $30 per head if he can break even on the gain. If the reverse is true—that is, low-price feed and high-price feeders—then the chance for profit is greater on the gain than on the margin. When feed is cheap, light yearlings or calves weighing from 300 to 500 pounds will cost less. With low-price feed the feeder may put from 600 to 800 pounds of gain per head on the cattle. His profit will result from the gain rather than from the margin.

Spread in feeder and slaughter cattle prices. If the price of feeders is low compared to the price of slaughter cattle, again the margin is important. Heavy cattle will usually bring in the most profit.

Future market outlook. Price prospects for fat cattle are important in determining which weights and grades of feeders to buy. If the immediate future outlook is good but the long-time outlook is uncertain, then heavy cattle, which will meet the grade most in demand for fat cattle, are more certain. Such cattle may be short-fed from 90 to 120 days and moved before the expected price break.

Length of feeding period. The amount of feed available usually determines the length of time cattle are fed. Cattle feeders having large amounts of feed they desire to market as beef generally desire light animals of a grade that will correspond to the quality of feed available.

These cattle are often calves bought in the fall, wintered to gain a pound a day, which is only a good growth gain, and turned on pasture the next spring. Some grain may be fed to the cattle while on grass. The second fall they are put into the feed lot and finished according to their grade.

SUMMARY

The breed of cattle to select depends upon personal likes, availability of breeding stock, outlet for surplus animals, and adaptability to the conditions under which they will be raised.

One may decide to go into the purebred business to raise breeding stock or into the raising of commercial cattle.

The more important breeds of beef cattle are Aberdeen Angus, Brahman, Hereford, Polled Hereford, Shorthorns, Polled Shorthorns, Galloway, and Santa Gertrudis. Santa Gertrudis are a new breed combining Shorthorn and Brahman breeding. Crossbreds have shown some advantages over straight breeds for commercial purposes.

Foundation animals should be selected with care. Animals with good production records and correct type are the most desirable. Low set, blocky animals, well-muscled in the areas of the valuable cuts, represent the proper type. Production records showing freedom from deformities and abnormalities, as well as growing ability, are very important in selecting breeding stock.

Feeder cattle are classified according to age, sex, weight, and grade. The classes and grades to select depend upon the kind of feed to be fed, cost, and market outlook. When poor-quality feed is to be largely used, lower grades of heavy cattle are usually the

better buy. If grain and good roughage make up the major part of the ration, choice to good feeders are generally more profitable. When feed is cheap and feeders high in price, light cattle stand a better chance of producing a profit. High-priced feed and low-priced cattle generally call for heavy cattle that can be finished quickly for slaughter.

QUESTIONS

1. What breed of cattle would be best suited to your farm? Why?
2. Why have Brahman and Brahman crossbreds become popular in some areas of the South?
3. Explain what you would look for in selecting breeding stock.
4. List some advantages and disadvantages of crossbreeding cattle.
5. How are feeders classified and graded?
6. When would it be wise to buy each of the following: high-grade light cattle, lower grade heavy cattle, and high-grade heavy cattle?

REFERENCES

Beef Cattle Investigations in Texas, College Station, Texas, Texas A & M, Bulletin 724.

Gerlaugh, Paul, Kunkle, L. E., and Rife, D. C., *Crossbreeding Beef Cattle*, Wooster, Ohio, Ohio Agricultural Experiment Station, Research Bulletin 703.

Ralston, F. A., *Beef Production in Montana*, Bozeman, Montana, Montana State College, Extension Bulletin 272.

Roubicek, C. B., Hilston, N. W., and Wheeler, S. S., *Progeny Studies with Hereford and Shorthorn Cattle*, Laramie, Wyoming, University of Wyoming, Experiment Station Bulletin 307.

< 13 >

Feeding and Management of the Breeding Herd

The breeding herd must be properly fed and managed if a good calf crop is to be obtained. The calf crop represents the earning from the herd. The breeder's income results largely from the sale of animals not needed in the breeding herd. The percentage of the calf crop, as well as the vigor and size the calves attain by market time, is largely determined by the feeding and management practices of the operator.

FEEDING THE HERD IN SUMMER

When an ample amount of good pasture is available, summer feeding problems of the breeding herd are easily solved. Young growing plants are generally high in most food nutrients and represent a fairly well-balanced ration for two-year-old heifers and mature cows.

FIGURE 110. *When cows have legume-grass pasture, the problem of summer feeding of the herd is pretty well solved. (Courtesy American Aberdeen-Angus Breeders' Association.)*

Studies reveal that cattle like to spend not more than eight hours per day in grazing. Whenever a pasture fails to provide sufficient forage to satisfy the animals within an eight-hour period, additional feed should be provided.

GRAIN AND FORAGE TO SUPPLEMENT GRASS

When additional feed is required, a good-quality, dry forage or some grain may be used to supplement the pasture. The amount of additional feed will depend upon the amount of grass available. The following amounts of feed, fed daily, will replace about one-half of the pasture requirement for mature cattle: (1) 10 pounds of good legume hay, or 30 pounds legume silage; (2) from 20 to 25 pounds of corn or sorgo silage; (3) from 3 to 5 pounds of corn, barley, or sorghum grain; (4) from 5 to 7 pounds of oats. Since grains are relatively low in protein, one-half pound of an accepted vegetable protein should be added to rations 2, 3, and 4. Cottonseed meal, soybean oil meal, and linseed oil meal are the more common protein supplements used in cattle feeds.

Vitamin Supplement on Grass. Green forage has an abundance of most vitamins needed in cattle nutrition. It is seldom necessary to supplement good pasture with any specially prepared vitamin mixture.

Mineral Supplement on Grass. Salt should be within easy reach of the cattle at all times. Although most pastures provide the essential minerals, there are some areas in which deficiencies of phosphorus and certain trace minerals have occurred. Since minerals are not expensive, a mineral mixture containing 40 pounds of iodized trace mineral salt, 28 pounds limestone, 30 pounds of steamed bone meal, 2 pounds iron (ferric oxide), or one containing 30 pounds of salt, 25 pounds limestone, 35 pounds bone meal, and 10 pounds of trace minerals will supply the needed minerals under most conditions. The mineral mixture should be placed in a feeder protected from rain and located where the cattle may have free access to it.

Protein Supplement on Grass. When an ample amount of green pasture forage is available, mature breeding cattle seldom need additional protein. If the pasture fails to provide enough feed for the herd and low-protein forage and grains are used to supplement the pasture, then from one-fourth to one pound of protein meal will be needed to balance the ration.

FIGURE 111. *Cattle will drink lots of water when it is easily obtained. (Courtesy Geo. A. Hormel & Co.)*

Water. Water is usually the cheapest and most essential element in livestock nutrition. The need for plenty of fresh, clean water within easy reach of the cattle cannot be overestimated. Cattle make faster gains and utilize feed more efficiently when plenty of water is available.

Pastures Compared. There is a wide variety of pasture plants. Weather, soil, and moisture conditions determine the pasture crops best adapted for each locality. Pasture crops are divided into two general classes: legumes and grasses.

Legumes. Legumes have the ability to use atmospheric nitrogen. Since nitrogen is important in the building of proteins, legumes are usually higher in protein than are the grasses. Legumes are heavy feeders on phosphorus and calcium and are generally rich in these essential minerals. Legumes are usually higher in food value than are grasses. In general, legumes are very palatable to cattle. Most of the common pasture legumes are deep-rooted and stand dry weather well, thus extending the pasture period. When legumes are used alone as the pasture crop, there is danger of bloat. The loss from bloat has been so great that straight legume pastures cannot be safely recommended. However, when legumes are grown with grass, the danger from bloat is greatly minimized. Legumes should not make up more than one-half of the plant stand, and care should be used in seeding to get an even mixture of the two types of plants. If the seeding is uneven, cattle may graze where the heavy stand of legumes occurs, and bloat will result.

Wherever legumes are adapted, they should make up part of the pasture mixture. Experiments conducted at several stations have shown that when a legume and grass pasture is used, it is superior to grass alone. Some of the advantages of legumes used in conjunction with grasses are: (1) faster gains, (2) longer grazing season, and (3) greater carrying capacity of the pastures.

Some of the more common pasture legumes are: alfalfa, alsike clover, trefoil, crimson clover, kudzu, Ladino clover, lespedeza, red clover, sweet clover, vetch, and white dutch clover.

Grasses. Like legumes there are many types of pasture grasses. Various areas have a number of grasses adapted to their climatic conditions. In selecting pasture grasses for seeding, those that will produce the most forage over an extended period and that are palatable to livestock are generally recommended; for example, bluegrass is common in the Midwest. It produces excellent forage during the cool, moist months but becomes more or less dormant during the hot, dry months. Brome grass, although no more palatable than bluegrass, stands dry weather well and will produce more forage in an average season.

The list of grasses used for pasture in the United States is almost endless. Many are native to certain areas, such as the Western and Southern range, and are well adapted to the weather and soil conditions that prevail there. In the typical range country, pastures are permanent, and only those grasses known to be well adapted should be used for re-seeding. Some of the better grasses to use in mixtures for temporary and semi-permanent pastures in the Midwest are: bluegrass, brome grass, tall fescue, orchard grass, redtop, perennial rye grass, sudan grass, and timothy. All these grasses are perennials except sudan grass, which is an annual.

Mixtures. There are many combinations of legume and grass seed mixtures. The length of time a pasture is expected to last is important in selecting a mixture. In the areas of the United States where the amount and distribution of the rainfall are sufficient for growing cultivated crops, many farmers use rotation pastures as a means of providing forage and maintaining soil fertility. Rotation pastures are left from one to four years and then ploughed. Land that is too wet or whose topography is too rough for cultivation is left in permanent pasture. Many permanent pastures become unproductive, and a reseeding and fertilization program is necessary. A third type of pasture, known as an "emergency pasture,"

is used when there is a need for more grazing area than has been provided for. Quick growing grasses that will provide forage the same year they are seeded make the best emergency pastures.

There is such a wide variety of soil and climatic conditions prevailing in the United States that no attempt will be made to give recommended pasture seed mixtures for all areas. Some recommended mixtures for the midwestern states that have wide adaption in other sections are listed in Table 15.

TABLE 15

GRASS AND LEGUME MIXTURES RECOMMENDED FOR THE MIDWEST *

Seeding Rate per Acre in Pounds

Rotation Pastures								
1.	Alfalfa	6–8	Smooth brome grass	5–10				
2.	Alfalfa	6–8	Meadow fescue	6–8				
3.	Alfalfa	6–8	Smooth brome	6	Meadow fescue	2		
4.	Alfalfa	6–8	Smooth brome	4–5	Timothy	1–2		
5.	Alfalfa	7–8	Red clover	3	Orchard grass	6		
6.	Alfalfa	5–6	Ladino	½	Smooth brome	8		
7.	Alfalfa	3	Ladino	½	Red clover	3	Smooth brome	8
8.	Alsike	3	Ladino	½	Red top	2–4	Timothy	2–3
9.	Red clover	6–8	Timothy	4–6				
Permanent Pastures								
1.	Birdsfoot trefoil	4–6	Bluegrass	3–4	Smooth brome	6–8	Timothy	2
2.	Birdsfoot trefoil	4–6	Alfalfa	3–4	Smooth brome	6–8	Timothy	1–2
Emergency Pastures								
1.	Sudan grass	15–25						
2.	Sudan grass	5–10	Soybeans	60–80				

* Table adapted from: Hughes, Heath, and Metcalfe, "Forages," *The Science of Grassland Agriculture*, Iowa State College Press, 1951.

For economical beef production, plans should be made for pasturing as much of the year as possible. Studies at Purdue University showed that 55.4 per cent of the feed cost for an entire year occurred during a 127-day wintering period. The cost of wintering rations was 2½ times as much as the cost of pasture per day.

The grazing period may be extended by using fall-seeded grains, such as rye, for early pasture. A mixture of sudan grass and soybeans will provide excellent pasture during midsummer and early fall. Sudan grass and soybeans are seeded in the spring after the danger of frost is past. Cattle may be turned on the sudan-soybean pasture, giving the rotation or permanent pasture an opportunity to recover and to provide more late fall feed. Sudan grass should not be pastured after frost because there is danger of prussic acid

poisoning from most plants in the sorghum family when their growth has been seriously retarded.

Feeding Suckling Calves. Suckling calves that are to be sold or placed in the feed lot immediately after weaning should receive grain in addition to milk and grass. Beef cattlemen who make a practice of feeding grain to suckling calves follow one of two common practices, creep-feeding the calves while they are running with the cows, or confining the calves in a smaller pasture or lot, where they may be fed, and turning them with the cows night and morning to nurse.

Creep-feeding calves. The practice of creep-feeding calves has the following advantages: (1) The calves will have more weight at weaning time; (2) the cows are suckled down less; (3) calves will not miss their mothers as much at weaning time; (4) calves will be more uniform in size as creep-feeding helps to make up for the difference in milking ability of the cow; (5) calves will be in better condition when they go into the feed lot, and the feeding period will be shortened; (6) heifers and bulls that are to be kept or sold as breeding animals will have more growth; (7) fat is a good seller even of feeder calves. Creep-fed calves are usually fatter than other calves and therefore sell better.

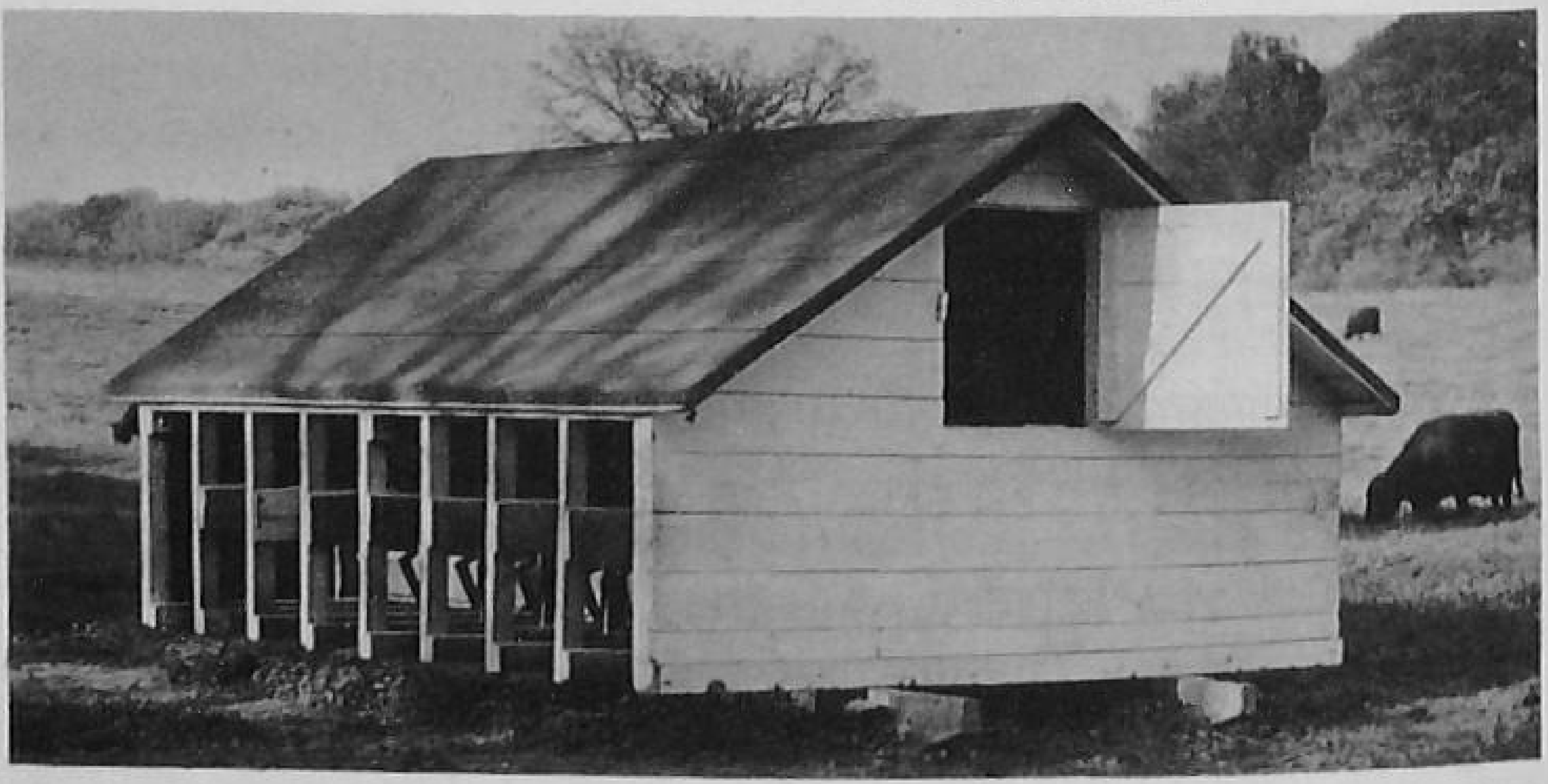


FIGURE 112. *A good type of calf creep. (Reprinted from* Successful Farming.*)*

It is sometimes difficult to get calves to start eating out of the creep. Late winter or early spring calves may be more easily started when the cows and calves are kept in confinement rather than on pasture. A creep, easily accessible to the calves, may be placed in one end of the cattle shed. If one feeds both cows and

calves a small amount of grain on the ground or in low-down bunks, calves that have not learned to eat grain when put on pasture with the cows may be encouraged to do so. After the calves have learned to eat, the feed may be placed in a pasture creep. Several grain and protein mixtures may be used. The kind of a mixture will depend upon the amount and quality of the pasture. For the best gain, fresh clean feed should be in the creep at all times. Some suggested mixtures to be fed in the creep are given in Table 16.

TABLE 16

SUGGESTED RATIONS FOR CREEP-FEEDING SUCKLING CALVES WITH GOOD LEGUME GRASS PASTURE

Age of Calf	*Ration*
1–3 months:	whole oats
3–4 months:	ground corn, barley, or sorghum grain, 2 parts; oats, 1 part
4–6 months:	ground corn, barley, or sorghum, 5 parts; oats, 1 part

If at least one-fourth of the pasture is not made up of legumes, then one part linseed, or soybean, meal should be added to increase the protein level of the ration. A mixture of equal parts of trace mineralized salt and bone meal should be kept where the calves have access to it.

Antibiotics for Suckling Calves. Experiments conducted at Purdue University showed a marked reduction in scouring among suckling calves and a growth stimulation when aureomycin was fed at the rate of 24 mg. per 100 pounds liveweight. Calves receiving aureomycin administered in capsule form daily at the above rate seldom showed any signs of scouring, while the control group, receiving the same ration except for the aureomycin, developed several cases of severe scouring. The aureomycin fed calves averaged 14.5 pounds per calf more at eighty days of age than the control calves not fed the antibiotics.

Feeding Cows During the Winter. In areas of the United States that are too far north for winter pasture, the cow herd may be wintered primarily on silage or dry roughages. If the roughage used is at least one-half good legume hay or legume silage and the cows are fed liberal amounts, they will go through the winter in good condition and produce a strong calf. Where low-quality roughages, like corncobs or cornstalks, are used, some high-energy feed, such as molasses, sorghum grain, barley, or corn and a protein concentrate, should be added to the ration.

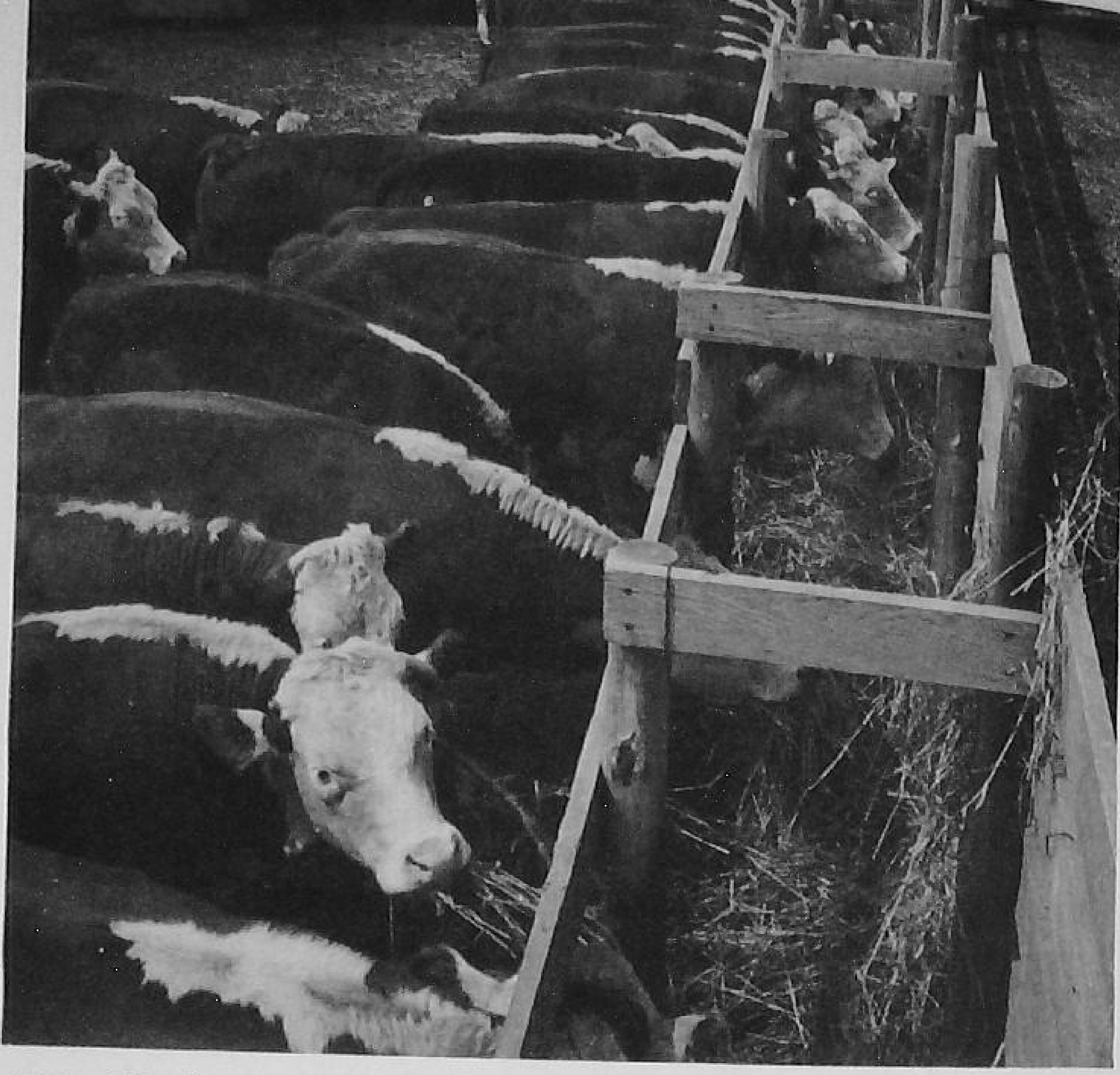


FIGURE 113. *Legume hay solves much of the winter cow herd feeding problem. (Courtesy Rath Packing Company.)*

Experiments conducted at Purdue University show that cows receiving 14.5 pounds of ground corncobs, one pound of dehydrated alfalfa meal, 3.5 pounds of Purdue cow supplement (fed daily), and a mineral mixture (fed free choice) wintered and produced as good a calf crop as did cows receiving 20 pounds of alfalfa-brome-timothy-hay plus minerals. The experiments show that low-quality roughages may be successfully used when properly supplemented. It should be pointed out that the economy of using low-grade roughages depends upon their cost. When poor-quality forage is fed, additional high-energy feed and proteins are necessary, offsetting, in part, the lower cost of the forage.

The Purdue supplement used in the cow-feeding trials consisted of 636.8 pounds of soybean meal, 285.8 pounds of 45 per cent molasses feed, 51.4 pounds of bonemeal, 17.2 pounds of iodized salt, and 2.5 pounds of vitamin A concentrate.

When corn or sorghum silage is used as the principal roughage, an addition of one or two pounds of soybean, linseed, or cottonseed meal should be fed to make up for the low protein content of the roughage. A large variety of rations that will successfully

winter mature beef cows may be used. Roughages should make up most of the winter ration because they are usually much cheaper than concentrates. It is important that any nutrient deficiencies of the roughages be compensated for by feeding concentrates. Table 17 lists several rations that may be used for wintering beef cows.

TABLE 17

RATIONS FOR WINTERING BEEF COWS

Ration	*Feed*	*Pounds Fed Daily*
1.	Legume hay	15–20
	Mixed minerals	Free choice
2.	Legume hay	5–10
	Oat straw	Unlimited
	Mixed minerals	Free choice
3.	Ground corncobs	14–15
	Dehydrated alfalfa meal	1
	Purdue cow supplement	3.5
	Mixed minerals	Free choice
4.	Corn or sorgo silage	30
	Legume hay	5
	Oat straw	Unlimited
	Mixed minerals	Free choice
5.	Corn or sorgo silage	30
	Chopped cornstalks	10
	Cottonseed, linseed, or soybean meal	1
	Mixed minerals	Free choice
6.	Legume grass silage	25
	Legume or grass hay	5
	Mixed minerals	Free choice

Vitamins. Vitamin A is usually the only vitamin that may be deficient in beef cattle rations. When legume hay or silage made from legumes, sorghums, or corn is fed, sufficient vitamin A will usually be provided. If the roughage is primarily cornstalks, straw, or corncobs, a protein supplement that has been reinforced with vitamin A is recommended.

Minerals. The mineral mixtures given for cattle on grass are sufficient, when fed free choice, for cows in dry lot.

FEEDING REPLACEMENT HEIFERS

After the replacement heifers have been weaned, it is important to feed them separately from the cows. Heifers need a better quality ration than do mature cows if they are to reach normal size at breeding time. Whenever it is possible, during the first and second winters, breeding stock should receive at least 5 pounds of good legume hay, plus additional amounts of sorgo or corn silage.

It is important to raise the replacement heifers as cheaply as possible without sacrificing growth and development. Table 18 lists some recommended rations for heifers. A mineral mixture should be fed free choice.

TABLE 18

Recommended Rations for Growing Heifers

	Feed	*Pounds Fed Daily*
1.	Legume hay	5
	Sorgo or corn silage	10–20
2.	Legume silage	15–30
	Mixed grains per hundred pounds live weight	½
3.	Grass hay	5
	Sorgo or corn silage	10–20
	Protein meal	½
4.	Grass hay	10
	Straw	Unlimited
	Mixed grains per hundred pounds liveweight	½
	Protein meal	½–1

Antibiotics for Growing Heifers. Experimental results reported at Kansas State College and Purdue University indicate that antibiotics, fed to calves and yearling cattle receiving a growing ration consisting largely of roughage, produced faster gains and more efficient use of feed.

At Kansas State College, two groups of heifer calves were fed a wintering ration of sorghum silage, 4 pounds Milo grain, and 1 pound Cottonseed Meal. One group received 36 mg. of aureomycin daily. The aureomycin-fed heifers gained an average of 1.16 pounds daily over a 119-day feeding period as compared to 1.03 pounds daily gain for the heifers not receiving aureomycin.

The level of aureomycin fed daily is important. Purdue scientists recommend a level of about 10 mg. to 100 pounds of liveweight. When greater amounts are fed, the antibiotics have a depressing effect on the appetite of the cattle.

HOUSING AND EQUIPMENT

Housing. Beef cows are much less sensitive to changes in weather conditions than are dairy cattle. Warm and expensively built barns are not needed for housing the beef cow herd. In the South or Southwest barns or sheds are seldom used. In the northern cattle areas buildings that open on the south and that provide a good windbreak and afford protection during storms are needed.

If the cattle program calls for late winter or early spring calving,

FIGURE 114. *Warm and comfortable even though the weather is cold. (Courtesy American Hereford Association.)*

greater protection for the cows and calves will be necessary. When calves are to be dropped during cold weather before the pasture season begins, warm barns or sheds that can be divided into calving pens are essential. Cows may be placed in separate stalls where they may remain until the calf is one week old. A common practice is to keep the calves housed in a warm building and to turn them out with the cows night and morning to nurse. When the cows are placed on pasture, the calves may run with them.

Equipment. Equipment for the cow herd should consist of a hay rack, feed bunks, a mineral feeder, watering facilities, and a place to store the feeds.

Hay racks. There are several types of hay racks. One that is economical and will eliminate waste should be used. Some cattlemen prefer a combination hay rack and grain bunk. These racks should be constructed in such a way that hay dropped by cattle in the process of taking it from the rack will fall into the grain box. It is preferable that racks be built on skids so they may be moved from place to place.

When loose hay is stacked outside or in a hay shed, a rack that may be moved as the cattle eat into the stack will save considerable labor in feeding.

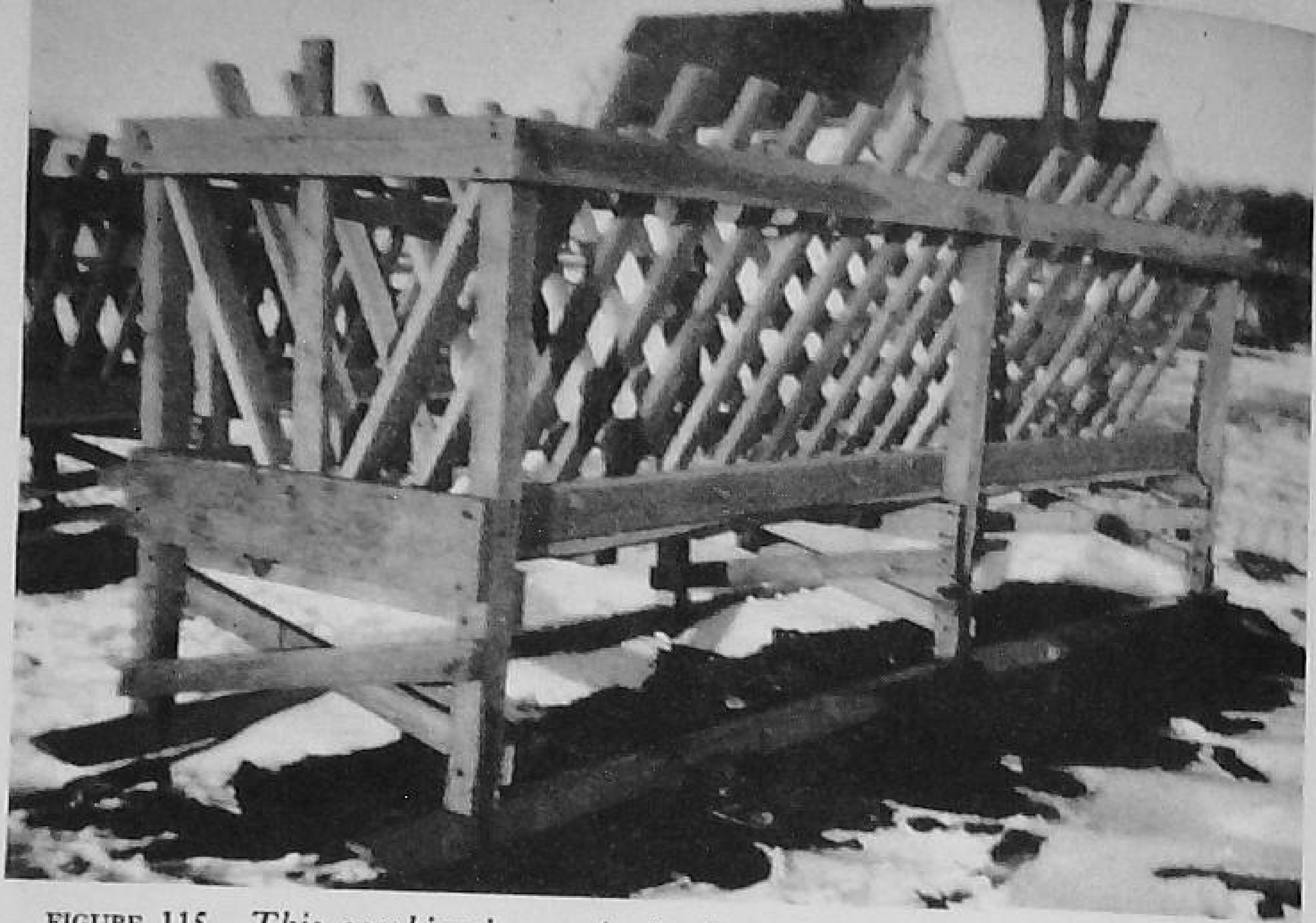
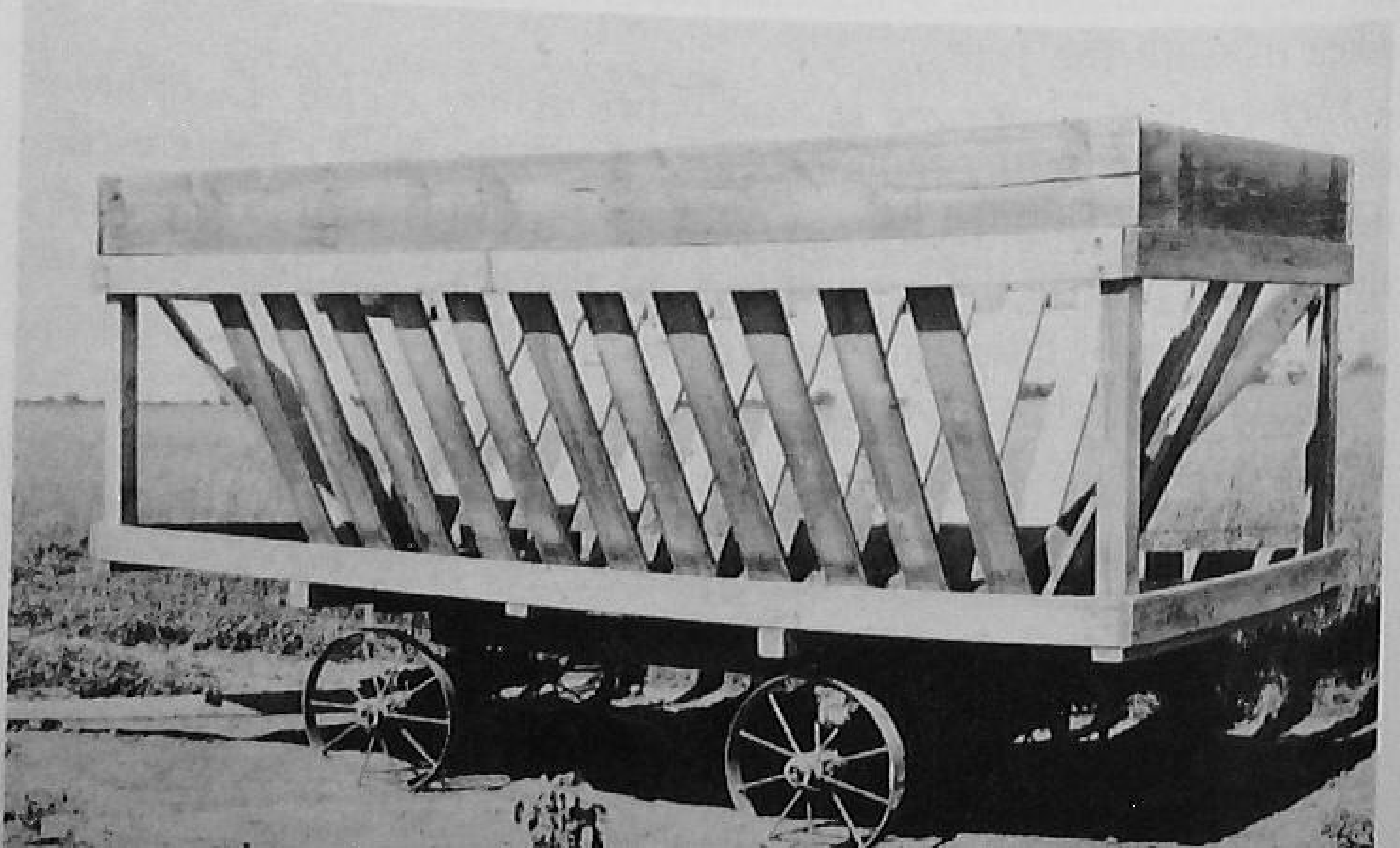


FIGURE 115. *This combination grain bunk and hay rack saves labor and feed.*

Feed bunks. Cattle feed bunks should be well built and placed on skids for moving. If grain or silage is to be fed, some type of feed bunk is necessary. Figure 116 shows a well-made feed bunk. Bunks should be built in such a way as to eliminate waste, and they should be the proper height to accommodate the kind of cattle that will be using them. When all the cattle in the lot will be feeding at the same time, at least 30 inches of feeder space per animal should be allowed for mature cows.

Mineral feeders. Mineral feeders, built to protect the mineral mixture from rain or snow, should be placed in an area where it will be easy for the operator to fill them and where the cattle can get at the minerals conveniently.

FIGURE 116. *A hay rack and feed bunk that is easily moved. (Courtesy* Wallaces' Farmer and Iowa Homestead.)



Watering facilities. Water is important to cattle at all times. Waterers may be of the stock-tank or fountain type. It is important that the water be fresh and clean.

Feed storage equipment. The kind of feed storage equipment needed will depend upon the kind of feed to be used. Where silage is the principal roughage, a trench silo will provide temporary, but cheap, storage facilities. Trench silos are constructed by digging a trench into the side of a sloping area where there will be drainage. The sides should be wider at the top to prevent crumbling of the walls. Trench silos may be made more permanent by concreting the sides.

Legume or grass silage may be stacked on top of the ground. If the stack is well packed, very little spoilage results. A silage stack will provide very good feed without cost for storage facilities. The upright silo is the most permanent but also the most expensive type.

Hay may be stacked outside on an area where drainage is good. If it is properly covered, it will keep well. In the more humid areas hay that is to be fed late in the season should be protected. Hay barns that shed water are all that are necessary for keeping the hay. To conserve labor these barns should be located close to the feed yard.

Grains other than ear corn should be placed in well-constructed, tight bins where moisture will not cause spoilage. Ear corn does not spoil easily if placed under a roof that will shed most of the rain and on a floor that is off the ground a few inches. Grain storage bins and cribs should be located near the feed lot to make for the greatest ease in feeding.

FIGURE 117. *The silage stack is an easy method of providing good feed. Note the use of a tractor to pack the stack. Packing is essential to prevent spoilage. (Courtesy Geo. A. Hormel & Co.)*

FIGURE 118. *Dehorning with the electric hot iron. (Courtesy Sunbeam Corporation.)*

DEHORNING

Horns that have been well trained and polished add to the attractiveness of show cattle of the horned breeds. Commercial cattlemen should remove the horns for the following reasons:

1. Cattle with horns usually sell for less on the market because of bruises inflicted by the horns.
2. More room is needed for horned cattle in the sheds and barns.
3. Cattle with horns inflict more damage on equipment.
4. There is more danger to the operator in handling cattle with horns.
5. Horned cattle inclined to fight will keep others away from the feed.
6. Feeders will pay more for cattle without horns.

When to Dehorn. Calves that are from three to ten days old can be dehorned more easily and with less danger of loss than can older cattle.

Methods of Dehorning. The age of the calf largely determines the method used for dehorning. Chemicals, electric dehorners, tubes, and spoons may be used if dehorning is done before the horn button becomes attached to the skull. For older cattle dehorning clippers and saws are most commonly used to remove the horns.

Chemicals. The horn buttons may be prevented from growing by burning them with chemicals. *This must be done before the calf is ten days old.* The chemicals that are commonly used are caustic potash or caustic soda. They come in a white stick about the size of blackboard chalk. Care should be used in handling them to prevent serious burns to the operator. The hair should be clipped around the horn button and a ring of heavy grease applied to the clipped area to prevent the burning action of the chemical from spreading too far. The end of the caustic stick is dipped in water and rubbed with a rotary motion on the horn button. In a few days a heavy scab forms over the horn, which drops off in about ten days. The calf suffers but little inconvenience, and there is no open wound to become infected.

Hot iron. Burning the horn button with an electric dehorner or hot iron is a method being used on many farms and ranges for dehorning young calves. Calves should not be over three months old if burning is to be effective in preventing horn growth. Electric dehorners have an automatic control which maintains temperatures at about 1000 degrees. Applying the electric dehorner to the horn button for ten seconds is sufficient to destroy the horn cells.

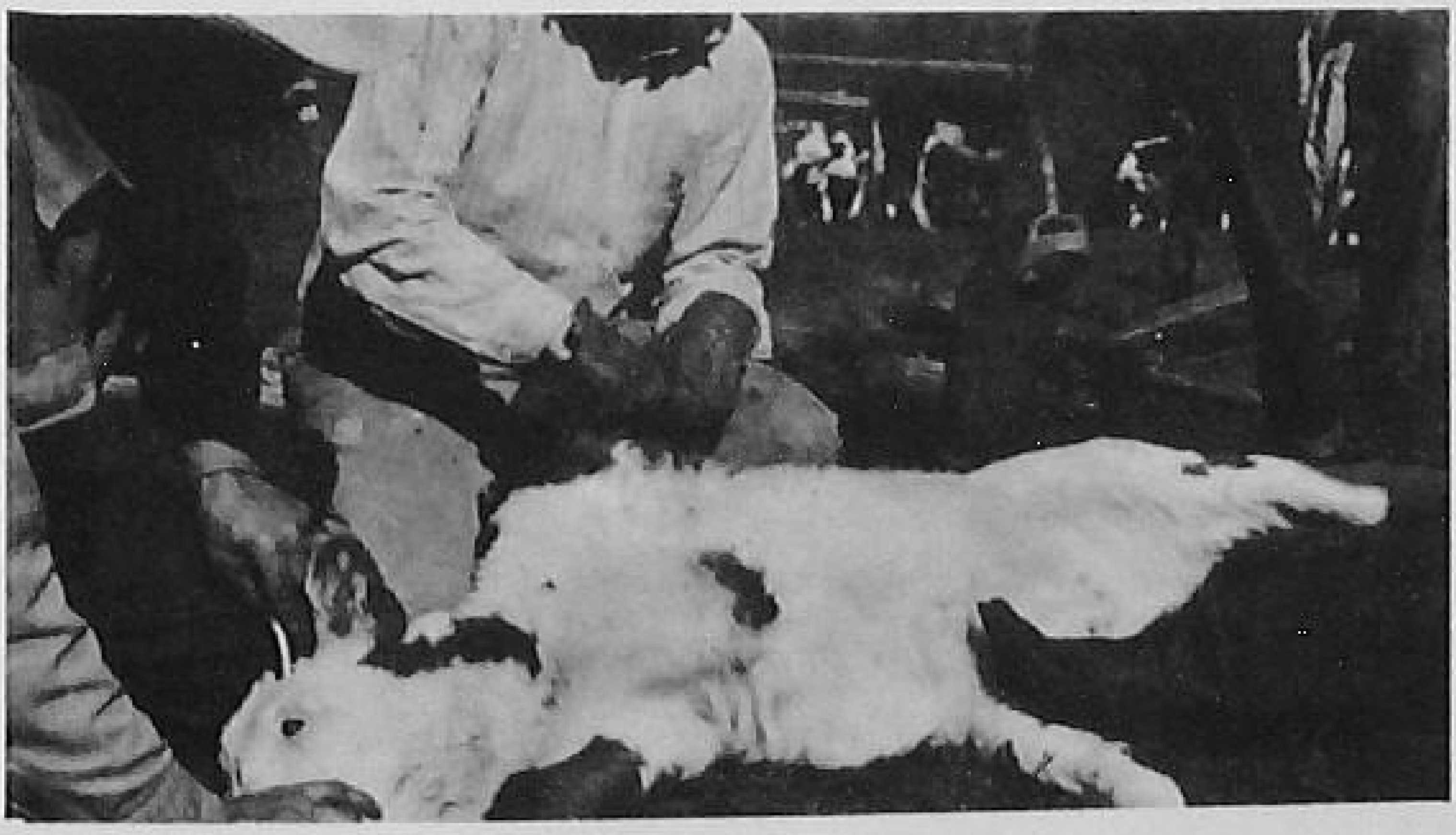


FIGURE 119. *Dehorning with a spoon. (Courtesy Tony Fellhauer, University of Wyoming.)*

The operation is bloodless and does not leave an open wound. Dehorning with the hot iron can be done any time of the year with very little danger of screw worm or any other type of infection.

Spoons and tubes. There are a number of instruments, such as spoons and tubes, on the market for dehorning. These dehorning

FIGURE 120. *(left) The use of rubber bands in dehorning cattle is a recent development. (Courtesy Don Collinson.)*
FIGURE 121. *(right) Dehorning with a clipper. This is a common method used when the horns have grown out. (Reprinted from* Successful Farming.*)*

instruments are constructed so as to permit gouging out of the horn button if used before the button has become fastened to the skull.

Clippers and saws. When older cattle are to be dehorned, especially designed clippers or saws are used. Considerable bleeding may follow the operation.

To prevent bleeding, the main horn artery should be tied off with a cotton or silk thread. This may be done by sliding a sewing needle under the artery to pull the thread in place before tying. It is necessary when sawing or clipping the horns to take about one-half inch of skin in order to get the horn roots. An open wound results; therefore, it is better to perform the operation during cool weather when there are no flies. In warm weather a good fly repellent should be smeared over the wound.

FIGURE 122. *The elastrator used in placing rubber bands over horns and ridger for grooving horns to keep bands in place. (Courtesy Don Collinson.)*

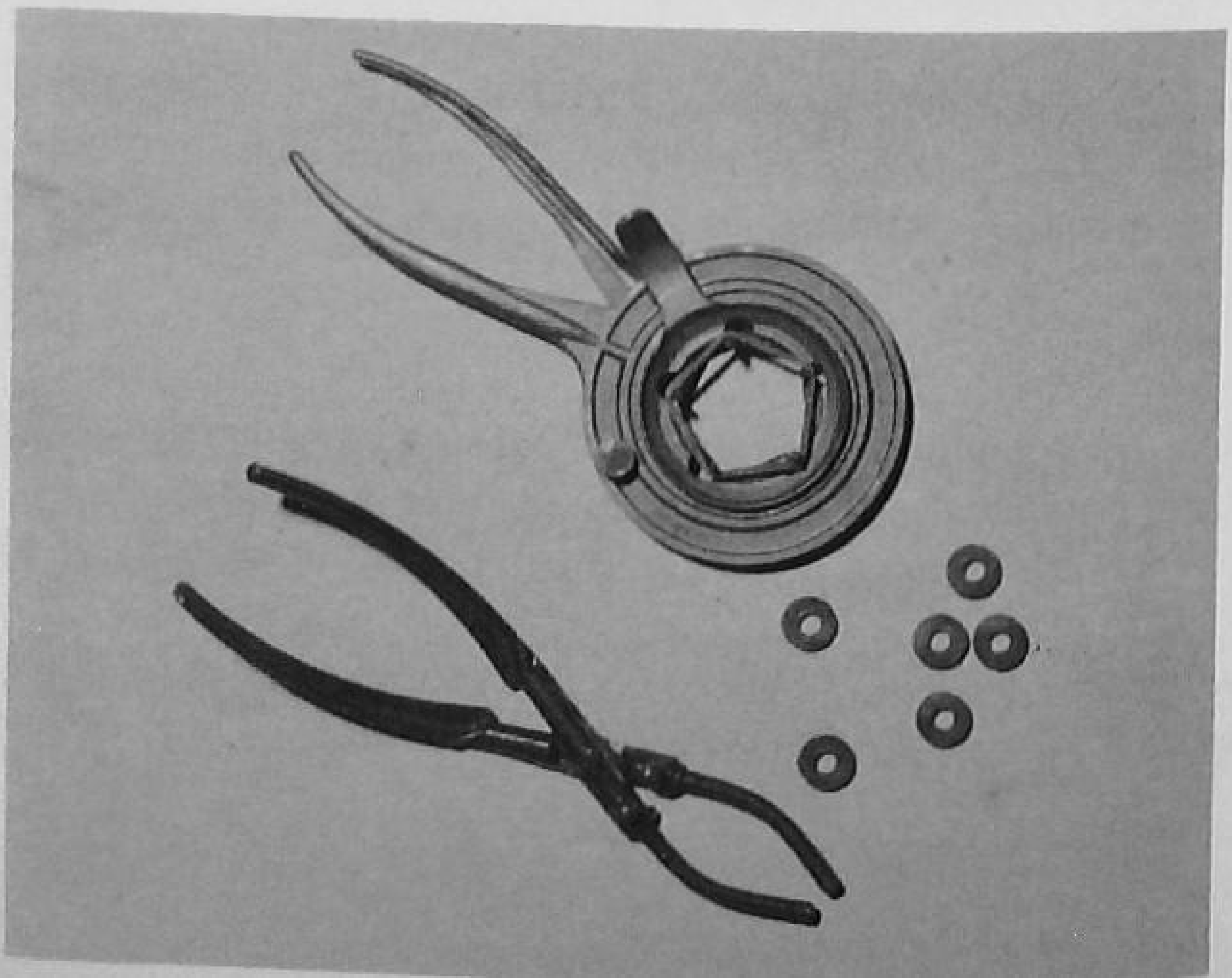


FIGURE 123. *The results of a good job of dehorning. (Courtesy Sunbeam Corporation.)*

CASTRATION

Castration is an operation to remove the testicles from young male animals. It should be performed when the animals are from four to twelve weeks old. If the calves are young, less setback will result. Like dehorning, castration should be done before or after the fly season.

Methods of Castration. Cutting off the lower one-third of the scrotum, exposing the testicles from below, splitting the membrane around the testicles, and pulling them out is a common method of castrating. For show cattle where a well-developed cod is desired, one testicle is pulled down at a time and held firmly so that the skin of the scrotum is tight over the testicle. An incision is then made on the outside of the scrotum next to the leg, both through the scrotum and the membrane. The testicle is pulled out as before.

An especially designed *castration pincer*, which may be used to pinch the spermatic cord leaving the testicle to wither and be absorbed, is popular in the South. The operation is bloodless and leaves no open wound in which screw worm and other infections could develop.

Marking. Cattle should be marked for identification. Hide brands are most common among ranchers. Ear notches, metal ear

markers, horn brands, and neck chains or straps are also used. A method that does not affect the appearance of the animal nor prevent quick and easy identification is preferable. Some breed associations require tattooing.

Breeding. *Age of heifers.* Heifers may be bred as yearlings to calve as two-year-olds if exceptionally well grown out; however, it is a practice not generally recommended. Heifers that are bred too young may suffer setbacks, resulting in small cows that may be barren. The practice of breeding at two years of age to calve at from thirty to thirty-two months is much safer.

Time for calving. When warm housing is available, early calving is recommended. Calves that are two or three months of age when the pasture season arrives will use more grass, and the feed cost will be cut down.

Age of bull. Young bulls 15 months old, if hand-mated, can be depended upon to breed ten to fifteen cows; two-year-olds, thirty; and three-year-olds, up to fifty. Bulls past seven years of age may decline in fertility. The variation is so great with individuals that the length of time they can be depended upon is not predictable. Some bulls have remained good breeders up to twelve years of age or older.

SUMMARY

When the cow herd is on good pasture, very little additional feed is needed except for minerals, which should be kept before the herd at all times. If the pasture is insufficient to provide for the animals' needs, grain or dry roughage should be used to supplement the pasture. If the pasture contains no legumes and other feeds must be used, one-half to one pound of a vegetable protein meal or cake should be provided.

Pastures should contain some legumes because legumes provide proteins and minerals and increase the carrying capacity of the pasture. If the pasture contains more than half legume plants, considerable danger of bloat will exist.

Where a pasture shortage becomes apparent, quick-growing grasses and legumes, such as small grains, sudan grass, and soybeans, may be used as a temporary pasture crop.

Suckling calves should be provided with a creep if they are to be placed in the feed lot or sold soon after weaning. Creep-fed

calves gain faster and are more uniform in size, cows suckle down less, and less time is required for fattening.

The cow herd may be fed mostly on roughage during the winter. When legumes make up a high proportion of the roughage, very little or no grain and protein supplements are needed. If the roughage is of poor quality, some grain and protein should be provided.

Replacement heifers should be maintained separately from the cows, and better rations should be provided to insure proper growth and maturity.

Housing and equipment need not be expensive. Mature cattle will winter well if given a good windbreak and some protection against storms. In the colder regions warm quarters will have to be provided if cows are to calve in late winter or early spring. To reduce labor in feeding, feed storage facilities should be located close to the cattle yards.

Young calves may be dehorned by the use of chemicals, hot irons, or dehorning tubes and spoons. For older cattle clippers and saws are used for dehorning.

Calves should be castrated at about four to twelve weeks of age. The testicles may be removed or the spermatic cord pinched with castrating pinchers.

Marking is important for identification. Hide brands, horn brands, ear notches, metal ear tags, or neck chains or straps may be used.

In general, heifers should be bred to calve when three years old. Young heifers may suffer setbacks from early calving. Late winter calves will be larger when pasture season arrives and will make greater use of grass.

QUESTIONS

1. Why is it seldom necessary to feed the cow herd grain or supplements when good pasture is available?
2. How can the kind and amount of supplemental feed for the cow herd be determined when feed in addition to pasture is necessary?
3. Give a good mineral mixture for cattle.
4. Why are legumes important in the pasture mixture?
5. What are some good legume grass mixtures?
6. What are some emergency pasture crops that may be used?
7. How does pasture affect the cost of maintaining the beef herd?
8. Under what conditions should calves be creep-fed?

9. What are some suggested creep rations for calves one to thre months old, three to four months old, and four to six months old
10. List some rations using both good and poor forage.
11. How should the rations for replacement heifers differ from thos for cows?
12. What equipment is essential for beef cattle raising?
13. What are the methods of dehorning?
14. What are the methods of castrating?
15. Why should cattle be marked, and what are some of the methods
16. At what age should heifers be bred?
17. How many cows per bull is recommended?

REFERENCES

Anderson, W. T., and Mayo, Henry, *Producing Beef Calves in Indiana* Lafayette, Indiana, Purdue University, Extension Bulletin 371.

Beresford, Rex, *Raising Beef Cattle in Iowa*, Ames, Iowa, Iowa Stat College, Extension Bulletin P 102.

Lindgren, H. A., *Feed Requirements and Values for Livestock*, Corn valles, Oregon, Oregon State System of Higher Education, Exten sion Bulletin 639.

Smith, Harry H., and Daugherty, Ford C., *Beef Production in Col orado*, Fort Collins, Colorado, Colorado A & M College, Extensio Bulletin 389-A.

Totusek, Robert, Hornback, E. C., Perry, T. W., and Beeson, W. M. *Corn Cobs for Wintering Beef Cows*, Lafayette, Indiana, Purdu University, Mimeo. A. H. 94, 1952.

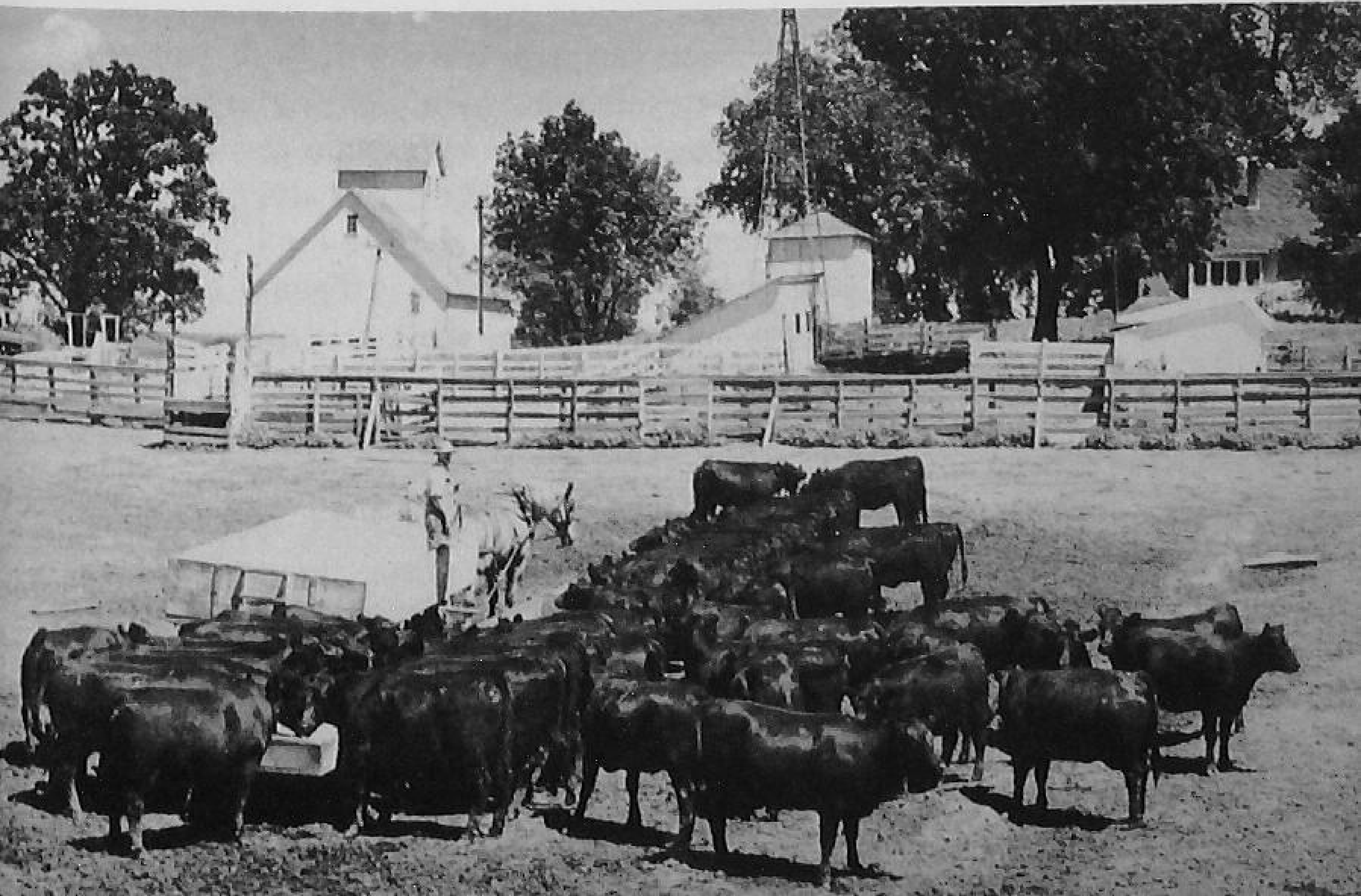
< 14 >

Feeding and Management of Feeder Cattle

The cattle feeding business is risky, especially for the inexperienced. The cattle feeder usually is one who has produced grain and roughage which he expects to convert into beef. In addition to the initial cost of the cattle, the feeder has his crops tied up in his cattle. If his feeding operations go wrong, through mistakes in judgment, he will lose heavily.

Securing Cattle. Farmers who have a considerable amount of grassland along with several acres of crops often maintain a cow herd and raise their own feeders. However, most of the cattle that go into the feed lots are purchased from the ranchers during the late summer and fall months and shipped into the grain-producing areas for fattening.

FIGURE 124. *These cattle are converting grain and roughage into beef. (Courtesy American Aberdeen-Angus Breeders' Association.)*



SOURCE OF PROFITS FROM FEEDING CATTLE

Those who fatten cattle do so because they expect to make a profit. Profit in cattle-feeding comes from two sources, margin and gain.

Margin. As explained in Chapter 11, margin is the price per hundred pounds that the feeder receives over his purchase price. Although it is desirable for the feeder to be able to show a margin, it is not always essential for making profit on the feeding operations. If a large enough profit is realized over feed cost and other feeding expenses, he may make a profit even though he actually has a loss on the original weight. For example: Suppose a 500-pound calf cost $20 per hundred pounds. If 500 pounds of gain are put on the calf at a cost of $15 per hundred and the animal is sold for $19 per hundred, the profit to the feeder will be $15 per head even though he lost $5 on the original weight.

The gain on cattle is an important source of profit. If the feeder can increase the market value of his feed by converting it into beef, he generally realizes a profit from his feeding operations.

FEEDING SYSTEMS

Cattle feeders follow one or more of several feeding programs. The best program for a given farm depends upon many factors, which will be discussed in connection with the various feeding programs.

Fattening on Grass. Cattle feeders who have a considerable amount of pasture available may decide to use this grass to replace roughage in the ration. When cattle are to be pastured, they are bought usually in the fall or early spring. When the pastures are ready, the cattle are turned on the grass. They may also be grain-fed while on grass. Some feeders prefer to sell the cattle directly off the grass in the fall, whereas others will finish them in dry lot. When plenty of good pasture is available, the cattle may run on grass without any additional feed until fall, when they go into the feed yards where they will be finished entirely on dry roughages and grains.

Advantages and disadvantages of pasture feeding. Some advantages of feeding cattle on grass are:

1. Pasture gains are cheaper because less grain and protein is used in the fattening process.
2. The manure is dropped on the pasture, saving labor in hauling.

3. No roughage other than grass is required, reducing the labor in feeding.

Some disadvantages of feeding cattle on grass are:

1. The cattle take longer to reach a desirable finish.
2. They have a lower carcass yield and usually sell for less.
3. Summer heat and flies may slow up the gains.
4. Cattle to be fed on grass have to be purchased either in the spring when feeders are scarce or in the fall when they must be wintered, thus increasing the length of time the cattle must be kept.

Fattening in Dry Lot. When very little or no pasture is available, cattle are generally placed in dry lot and started on feed for fattening. If the cattle are purchased in the early fall, they may be started on grain, fed long enough to become used to grain, and then turned into the cornfield following corn picking. The cattle will clean up the corn that is left in the fields. After the cornfields have been cleaned up, the feeders go into the lots where they are given full feed until they are ready for market.

Starting on Feed. When cattle are shipped in from a distance, they are tired and need rest. They should have plenty of water and comfortable quarters. Until the cattle become adjusted to their new home, no attempt should be made to start grain-feeding. Giving cattle all the hay, or silage and hay, they can eat for from ten to fifteen days before starting them on grain is a common practice. If cattle are bought early, they may go on pasture until fully recovered from the effects of shipping. After the cattle have become completely adjusted to their new environment, they may be started on whatever concentrates the feeding program calls for. If grains are to be the principal concentrates, yearlings may be started on from 2 to 3 pounds of corn, or its equivalent in other grains, per head and continued on this amount until all the cattle are eating grain. Many western cattle have never tasted grain and must learn to eat it. Care must be exercised to prevent a few that start to eat quickly from overeating. The corn may be increased one pound per head daily until the cattle are consuming one and one-half pounds per 100 pounds live weight. Further increases should be made at the rate of one pound every four days until they are receiving 2 pounds per 100 pounds live weight, which is generally considered full feed. Whatever protein is to be fed should be started with the grain. One-half pound of linseed, soy-

FIGURE 125. *Good hay cheapens the gain. (Courtesy American Hereford Association.)*

bean, or cottonseed meal, or any other accepted cattle protein may be used. The amount of increase will depend upon the kind of roughage used. From one to one and one-half pounds is usually sufficient for full feeding if legume hay or legume silage is used in the ration. When low-quality roughages are used in quantity, from 3 to 3½ pounds may be necessary.

To start calves, feed from 2 to 3 pounds of oats per head daily until all calves are eating. When all calves are eating, add one pound of shelled corn per head. Increase the corn one-half pound daily until the calves are consuming 2 pounds of grain per 100 pounds live weight. The oats may be continued at from 2 to 3 pounds or gradually cut back and discontinued. Protein may be fed the same as for yearlings.

FEEDS FOR CATTLE

Cattle feeds are many and varied. The rations used depend upon the kind of cattle to be fed and the cost and availability of the feed. The feeding value of different feeds will be discussed in such a way as to enable the cattleman to select the feeds best suited to his conditions.

Cured Roughages for Fattening Cattle. Roughages should make up a large part of the cattle ration. They are economical an

when properly fed decrease the cost of gain. Roughages vary considerably in feeding value.

Legumes. Legumes, either dry or in silage, are recognized as the best roughages from a nutritional standpoint. They are high in protein, minerals, and vitamins. Alfalfa, the clovers, lespedeza, and soybeans are all common legumes used for hay and silage.

Grasses. Many of the grasses, such as brome and western native grass, are excellent roughages but low in protein and minerals compared to legumes. One pound of protein meal is usually all that is needed when legumes are used as roughages. If grasses are the chief roughage, this amount generally needs to be increased by one-half pound or more for fattening cattle.

Corn and sorgo silage. Corn and sorgo silage are excellent roughages, except for their low protein content. Because of the grain contained in the silage, less grain is required for fattening when these roughages are used.

Corncobs. Corncobs have been used successfully when properly supplemented for fattening. Cobs are high in fiber and very low in protein, vitamin, and mineral content. If cattle were fed corncobs alone, they would probably slowly starve. Experiments at Purdue University have shown that cobs produced gains comparable to hay and corn when fed as the only roughage together with a full feed of ground ear corn and 3.5 pounds of Purdue Cattle Supplement A. Purdue Supplement A is a well-fortified protein supplement designed to offset the deficiencies in corncobs. Ohio Agricultural Experiment Station tests have shown that choice calves and yearlings full-fed a corn and cob meal mixture containing one-third cobs by weight, 2 pounds of soybean oil meal, plus

FIGURE 126. *Grass silage is relished by cattle. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

mixed hay, salt, and minerals fattened to grade choice in from 200 to 250 days.

Cornstalks. Like corncobs, cornstalks when properly supplemented will produce substantial gains on fattening cattle. Tests at the Iowa Agricultural Experiment Station showed that steers receiving 7.01 pounds of dry chopped cornstalks, 2.12 pounds of supplement, 3.12 pounds of mixed hay, 9.7 pounds of cracked corn, minerals, and salt gained an average of 1.76 pounds daily. The supplement was Iowa No. 2, which will be discussed later.

These experiments show that cheap roughages have a place in beef-cattle feeding. If high-fiber roughages are to be utilized by cattle, they will need to be fed in conjunction with some high-energy feed, such as molasses, corn, or sorghum grain, plus substantial amounts of protein supplements fortified with vitamins and minerals.

The bacteria that are responsible for the ability of cattle to digest high-fiber feeds must be supplied with enough energy and protein nutrients for their own growth. Unless these bacteria are well fed, ruminants fail to get enough feed value from cobs, cornstalks and similar feed to survive and produce gains. If the bacteria are properly fed, they grow and digest the high-fiber feed. As the bacteria die, they are in turn digested by the ruminants.

The kind of roughage used will depend largely upon the cost of the feed and kind of cattle to be fed. Young calves are less capable of handling low-quality roughages than are older cattle. Top grade alfalfa hay is usually used as a standard for measuring the value of other roughages. A study of the results reported from several experiment stations that have run feeding tests on various roughages indicates that the price comparisons shown in Table 19 may be used as a guide for determining the value of different kinds of roughages for cattle feeding.

TABLE 19

Comparative Value of Roughages When Alfalfa Is Worth $20 per Ton

Roughage	*Value*	*Roughage*	*Value*
Alfalfa	$20.00	Sudan grass hay	$12.00
Red clover hay	18.00	Legume grass silage	8.00
Soybean hay	16.00	Corn silage	7.50
Lespedeza hay	15.00	Sorghum silage	7.00
Brome grass hay	13.00	Cornstalks (chopped)	6.00
Timothy hay	12.00	Corncobs (ground)	6.50
Prairie hay	13.00	Oat straw	5.00

Grains and Grain Substitutes for Fattening Cattle. The grains are the most important concentrates used for fattening cattle. Corn, barley, sorghum grain, rye, and wheat are the major grains.

Corn. Corn is the standard fattening grain, and all other grains are compared to corn in determining their value. Corn may be fed shelled, cracked, or as ground ear corn. Shelled or cracked corn furnishes more nutrients per pound than does ground ear corn, and will produce faster gains. It takes more experience to feed shelled or cracked corn because there is greater danger of the cattle overeating and going off feed. Although gains will be somewhat slower, ground ear corn can be fed more safely and has the advantage of utilizing the cob.

Barley. Barley may substitute for corn up to one-half of the grain ration. Barley has about 85 per cent of the value of corn for cattle feed. Feeding tests show that from 12 to 15 per cent more pounds of barley are used per 100 pounds gain. Feeding whole barley is wasteful. Barley should be crushed or rolled for greatest feed efficiency.

Wheat. Wheat may replace all or any part of the corn fed, but it is better when it does not exceed 50 per cent of the ration. Wheat should be cracked or rolled. When fed whole, much of it passes through the animal undigested. If it is finely ground, it is less palatable.

Oats. Oats are better for young calves than for older cattle. They are considered more of a growing feed than a fattening feed. Oats provide bulk when added to corn. If cattle are to be fed on shelled or cracked corn, adding half oats at the start and continuing to use from 2 to 3 pounds of oats in the daily ration will eliminate part of the danger of cattle going off feed from overeating. When used as a fattening ration, they are low in feed value compared to corn.

Rye. Rye is not palatable to cattle, and if fed in large quantities for a long period, it may slow down feed consumption, resulting in slower gains. Rye should not exceed 25 per cent of the grain ration. It can be used as a corn saver if the price is right.

Grain sorghums. Grain sorghums can replace corn in the cattle fattening ration, and will produce equal results. Experiments conducted at the Texas Agricultural Experiment Station showed that milo or feterita produced as much daily gain as corn, but more pounds of feed were required per 100 pounds of gain than for

corn-fed cattle. Grain sorghums are hard and grinding improves them for cattle feed.

Molasses. Molasses is well liked by cattle and is often used as an appetizer. It is not a protein but a carbohydrate feed and a partial replacement for corn. Molasses has a feeding value equal to about 70 per cent of corn. Because of its palatability, its chief value is in increasing feed consumption. Molasses may be purchased in liquid form, mixed with water, and then sprinkled over the feed or used in a dry form and mixed with the ration.

Table 20 gives the comparative values of grain and grain substitutes for fattening cattle, the standard bushel weights, and approximate weight of one quart. It should always be remembered that livestock rations should be figured on a pound, rather than on a bushel, basis. Grains vary as to bushel weights.

TABLE 20

COMPARATIVE FEED VALUE ON A PER-POUND BASIS OF GRAINS AND GRAIN SUBSTITUTES FOR FATTENING CATTLE

Feed	*Bushel Weight (lbs.)*	*Value Compared to Corn (%)*	*Approximate Quart Weight (lbs.)*
Shelled corn	56	100	1.7
Corn (ear ground)	70	85	1.4
Barley (ground)	48	85–90	1.1
Wheat (cracked)	60	100	1.7
Oats (ground)	32	70–75	.7
Rye (cracked)	56	70–80	1.5
Sorghum grain (ground)	50–60	90–95	1.4–1.5
Molasses (liquid)		70	3.

Proteins and Protein Substitutes for Fattening Cattle. Usually 100 pounds of protein supplement in a balanced fattening ration for beef cattle will save from 250 to 300 pounds of corn or corn substitutes. If the cost of the protein is greater than the value of the feed saved, its value in the ration may be questioned. The need for a protein supplement is largely determined by the protein content of other feeds in the ration. Agronomists have been doing considerable work to raise the protein content of corn through breeding and fertilization. Corn as high as 12 per cent protein has been produced. If corn 10 per cent in protein and legume hay or legume silage is used to make up most of the ration, the need for additional protein would be doubtful.

Soybean oil meal. Soybean oil meal is becoming popular as a cattle protein supplement. It is equal to other common protein

meals and with the increase in soybean acreage is often cheaper than other similar feeds.

Linseed oil meal. Linseed meal has long been a favorite source of protein among cattle feeders. It gives cattle a sleek hair coat which often results in a higher selling price.

Cottonseed meal. Cottonseed is a rich source of protein that is widely used among cattlemen. Cottonseed meal is better in a ration where silage is used. It should not be fed to calves under four months of age, because it may produce a toxic effect.

Urea. Urea is a nitrogen compound from which bacteria in the rumen of the cattle stomach can make some of the protein amino acids. Urea cannot be fed in large quantities because of its toxic effect, although it can be used to replace part of the protein feeds in the ration. Urea should be used in a mixed protein supplement containing vegetable protein meals. Experiments at Purdue University, the Iowa Agricultural Experiment Station and others have shown that .1 pound of urea plus .75 pound of linseed oil meal is equal to 1.5 pounds of linseed oil meal, or 1760 pounds of linseed oil meal plus 240 pounds of urea is equal to 4000 pounds of linseed meal. If soybean oil meal is used with urea feed, then .1 pound of urea plus .65 pounds of soybean oil meal equals 1.25 pounds of soybean oil meal.

Urea has no energy value; therefore, additional corn or other high energy feed is needed in the supplement.

Mixed proteins. Mixed proteins have some value over single protein supplements, especially where urea is used. It has been explained that urea can only be used to make up a part of the supplement. It is therefore necessary to mix it with other ingredients. Following are four mixed protein mineral vitamin supplements used by the Purdue and Iowa Agricultural Experiment Stations. These mixtures are especially designed for use with low quality roughages, such as cobs or corn stalks.

1. *Purdue Cattle Supplement A with Urea*

	Pounds
Soybean oil meal	400.5
Molasses feed (50% molasses)	280.0
Corn or its equivalent	208
Urea	40
Bone meal	52
Salt (mineralized)	17
* Vitamin A and D concentrate	2.5
	1000

2. *Purdue Cattle Supplement A*

	Pounds
Soybean oil meal	643.1
Molasses feed (50% molasses)	285.8
Bone meal	51.4
Salt (mineralized)	17.2
* Vitamin A and D concentrate	2.5
	1000

* (2250 I. U. of A and 300 I. U. of D per gram.)

3. *Iowa Cattle Supplement I*

	Pounds
Linseed oil meal	1200
Urea feed	458
Bone meal	240
Iodized salt	64
Trace minerals	16
Vitamin A and D oil (2250–300)	16
Live yeast feed	6
	2000

4. *Iowa Cattle Supplement II*

	Pounds
Linseed oil meal	666
Distillers' grains	666
Molasses (cane)	268
Urea feed	214
Bone meal	134
Iodized salt	36
Trace minerals	8
Vitamin A and D oil (2250–300)	8
	2000

Purdue University recently announced two new supplements:

Improved Purdue A

	Pounds
Soybean meal	650.5
Molasses	140.0
Alfalfa meal	140.0
Bone meal	52.0
Salt with cobalt	17.0
Vitamin A and D concentrate	.5
	1000

Note–One ounce of cobalt sulfate was added per 100 pounds salt.

Purdue G

	Pounds
Alfalfa meal	400
Molasses	329
Dried brewer's grains	132
Bone meal	105
Salt with cobalt	34
	1000

(1) Improved Supplement A and Purdue Supplement G; Improved Purdue A was designed to be fed under the same conditions as Purdue A. Experiments showed greater gains with less feed cost when the Improved A was fed as compared to the original Purdue A.

Purdue Supplement G is lower in protein, and was designed for use when legume-grass silage was fed as the principal roughage. The formulas for Improved Purdue Supplement A and Purdue Supplement G are listed on pages 231–232.

Antibiotics for Fattening Cattle. Recent experiments have indicated some increased rate of gain and feed efficiency when antibiotics, especially aureomycin, have been fed to fattening cattle. Cattle receiving a comparatively low quality ration have shown the greatest percentage of gain while those receiving a high energy ration consisting of full grain feeding and high quality roughage have shown very little, if any, increased rate of gain when fed antibiotics.

Kansas State College reports an average daily gain, over a 122-day period of feeding, of 1.72 pounds for steer calves receiving a daily ration consisting of Ellis silage 42.02 pounds, Milo grain 1.75 pounds, Cottonseed Meal 1.25 pounds, and 45 mg. aureomycin. The control group consumed 42.5 pounds daily of Ellis silage and were given the same amount of Milo and Cottonseed Meal but no aureomycin. The control group gained an average of 1.54 pounds daily. The feed required per 100 pounds of gain was Ellis silage 2757.98, Milo grain 113.56 and Cottonseed Meal 81.12 for the control group, and Ellis silage 2440.95, Milo grain 101.67, and Cottonseed Meal 72.62 for the aureomycin fed group.

Purdue scientists found the addition of aureomycin valuable to cattle on a growing ration but not for steers on a fattening ration consisting largely of high energy feeds. Most of the advantage from aureomycin feeding came during the first three or four months of the feeding periods.

Rations for Fattening Cattle. Using the feeds that have been discussed, a large variety of fattening rations may be developed. Many areas produce feeds, not included here, that may be successfully substituted. It is important to use rations that will supply needed nutrients as cheaply as possible. Home grown feeds are usually cheaper than feeds shipped in. In selecting a ration, the age and quality of cattle should be considered. Cattle being fin-

ished for high choice or prime grades usually are limited on roughages in order to induce them to consume more fattening feeds. Cattle of plainer grades, which are unable to finish as top slaughter grades, may be given roughages free choice. Since the selling price of plain cattle is less, cheaper gains are essential. The following are some suggested rations for cattle on full feed:

TABLE 21

RATIONS FOR CATTLE THAT ARE INTENDED TO MAKE PRIME OR CHOICE GRADES

	Feed	*Pounds*
1.	Legume hay	½ lb. per cwt. live weight fed daily
	Corn	850
	Oats	100
	Linseed, soybean, or cottonseed meal	50
2.	Legume hay	½ lb. per cwt. live weight fed daily
	Ground ear corn	900
	Linseed, soybean, or cottonseed meal	100
3.	Legume hay	½ lb. per cwt. live weight fed daily
	Corn	500
	Barley	450
	Linseed meal	50
4.	Legume hay	½ lb. per cwt. live weight fed daily
	Legume grass silage	2 lbs. per cwt. live weight fed daily
	Sorghum grain	600
	Barley	350
	Linseed, soybean, or cottonseed meal	50
5.	Legume hay	½ lb. per cwt. live weight fed daily
	Legume grass silage	2 lbs. per cwt. live weight fed daily
	Corn	500
	Sorghum grain	450
	Linseed, soybean, or cottonseed meal	50
6.	Legume grass hay	½ lb. per cwt. live weight fed daily
	Corn	825
	Oats	100
	Linseed, soybean, or cottonseed meal	75
7.	Legume grass hay	½ lb. per cwt. live weight fed daily
	Ground ear corn	875
	Linseed, soybean, or cottonseed meal	125
8.	Grass hay	½ lb. per cwt. live weight fed daily
	Sorghum or corn silage	2 lbs. per cwt. live weight fed daily
	Corn or sorghum grain	850
	Linseed, soybean, or cottonseed meal	150

If the feeder has an abundance of low quality forage, he may desire to buy plain cattle and utilize this roughage. Some sug-

gested rations used by the Iowa Agricultural Experiment Stations in feeding trials are given in Table 22.

TABLE 22

RATIONS FOR FATTENING CATTLE USING LOW QUALITY FORAGE

Feed	*Pounds Fed Daily*	*Average Daily Gain (Pounds)*
1. Chopped corn stalks	10.45	
Mixed hay	2.00	1.87
Cracked corn	4.50	
Purdue Supp. A	3.50	
2. Chopped corn stalks	10.31	
Mixed hay	2.00	
Cracked corn	6.75	1.74
Iowa Supp. I	1.25	
3. Ground corncobs	11.26	
Mixed hay	2.00	
Cracked corn	5.25	1.87
Iowa Supp. II	2.75	

Rations for Wintering Feeders. Feeders who have an abundance of pasture which they wish to utilize often buy cattle in the fall, carry them through the winter on a growing ration, and turn them on grass in the spring. Cattle that are wintered should be fed a ration that will produce from 1 to 1½ pounds per day gain, which is considered a normal growth rate.

TABLE 23

WINTERING RATION FOR STEERS

Feed	*Pounds Fed Daily*
1. Legume-grass hay	Full feed
Minerals	Free choice
2. Corncobs	12–14
Purdue Supp. A	3–3.5
Minerals	Free choice
3. Legume-grass hay	5
Corn or sorghum silage	15–25
40% protein meal	½
Minerals	Free choice
4. Legume-grass hay	5
Legume-grass silage	15–25
Minerals	Free choice
5. Legume-grass hay	5
Corn and cob meal	½ pound per cwt. live wt.
Minerals	Free choice

Pastures for Feeders and Fattening Cattle. Good pastures are essential for maximum growth and fattening of cattle on grass. Like breeding cattle, feeders make greater gains on legume-grass

pastures than on straight grasses. The pasture mixtures discussed in Chapter 13 are applicable for feeders and fattening cattle.

Factors Influencing Gains on Grass. What kind and weight of cattle should be turned on grass is a question facing many cattle feeders. Several factors, such as age and weight, affect the gains cattle will make on grass.

Age and weight. Big, thin cattle have more frame on which to put fat and a greater capacity for grass consumption. They can be expected to improve fastest in condition. Yearlings would rank second in total pound gain, and calves would be last. However, in proportion to starting weight calves will make greater gains per 1000 pounds than older cattle.

Condition. Cattle that have been wintered well, and are in high condition, will need grain while on grass if they are to continue to gain. It is not economical to turn cattle, carrying too good a condition, on grass without grain. Such cattle will lose weight rather than gain.

Concentrate for Cattle on Grass. The kind and amount of concentrates fed cattle on grass depend upon the gains expected, the amount of pasture and grains available, and the time cattle are to be marketed. Cattle can be expected to make greater total gains if fed grains on pasture than cattle receiving pasture only. However, when concentrates are fed, less gain due to grass alone will result. It may be more economical not to feed grain to cattle that are on pasture if the feeder expects to market them at the end of the grass season or after a short dry-lot feeding period.

Rations for cattle on grass. Cattle receiving concentrates while on pasture may be fed the same mixtures, except for roughage, as those in dry lot. The roughage will be provided by the grass. If the pasture is from 20 to 50 per cent legumes, the amount of protein supplement may be reduced to one-half the amount generally recommended for a dry lot ration in which legume hay or silage is fed.

FEED EFFICIENCY FACTORS

Rate of Gain. Thin two-year-old cattle will make the greatest gains in the feed lot, followed by yearlings and two-year-olds. This may be explained on the basis that big cattle consume more total feed that may be turned into beef and, therefore, make more rapid gains.

Economy of gains. Calves will produce 100 pounds of gain on

less feed than older cattle, although the time required for the same gain will be greater. The gain in body weight of older cattle is due largely to fat from high energy feeds; the gain on calves is due in part to growth. Calves digest their feed more thoroughly than older cattle.

As cattle fatten, the amount of feed required per hundred weight gain becomes greater. Experiments show that cattle weighing around 600 pounds started on feed require about 10 units of feed for the first 100 pounds of gain, 13 units of feed are required for the second 100 pounds, 14–15 units for the third, 17–18 units for the fourth, and 22 or more for the fifth hundred weight of gain. Roughage consumption goes down as cattle fatten, and is replaced by higher priced feeds. The difference in market price for highly finished cattle as compared to medium is the important consideration in deciding how long to feed cattle.

EQUIPMENT FOR FATTENING CATTLE

The equipment needs for fattening cattle not being great, sheds or housing facilities need furnish only protection from storms and extreme cold. Many cattlemen have successfully fed cattle using a good tree or high board fence windbreaks for protection. Paved lots are valuable manure savers and serve to keep cattle out of the mud during the spring or rainy seasons. Feed bunks, hay rack,

FIGURE 127. *Feed supply located close to the cattle yard saves time and labor. Note hay stack, silo, and grain bin. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

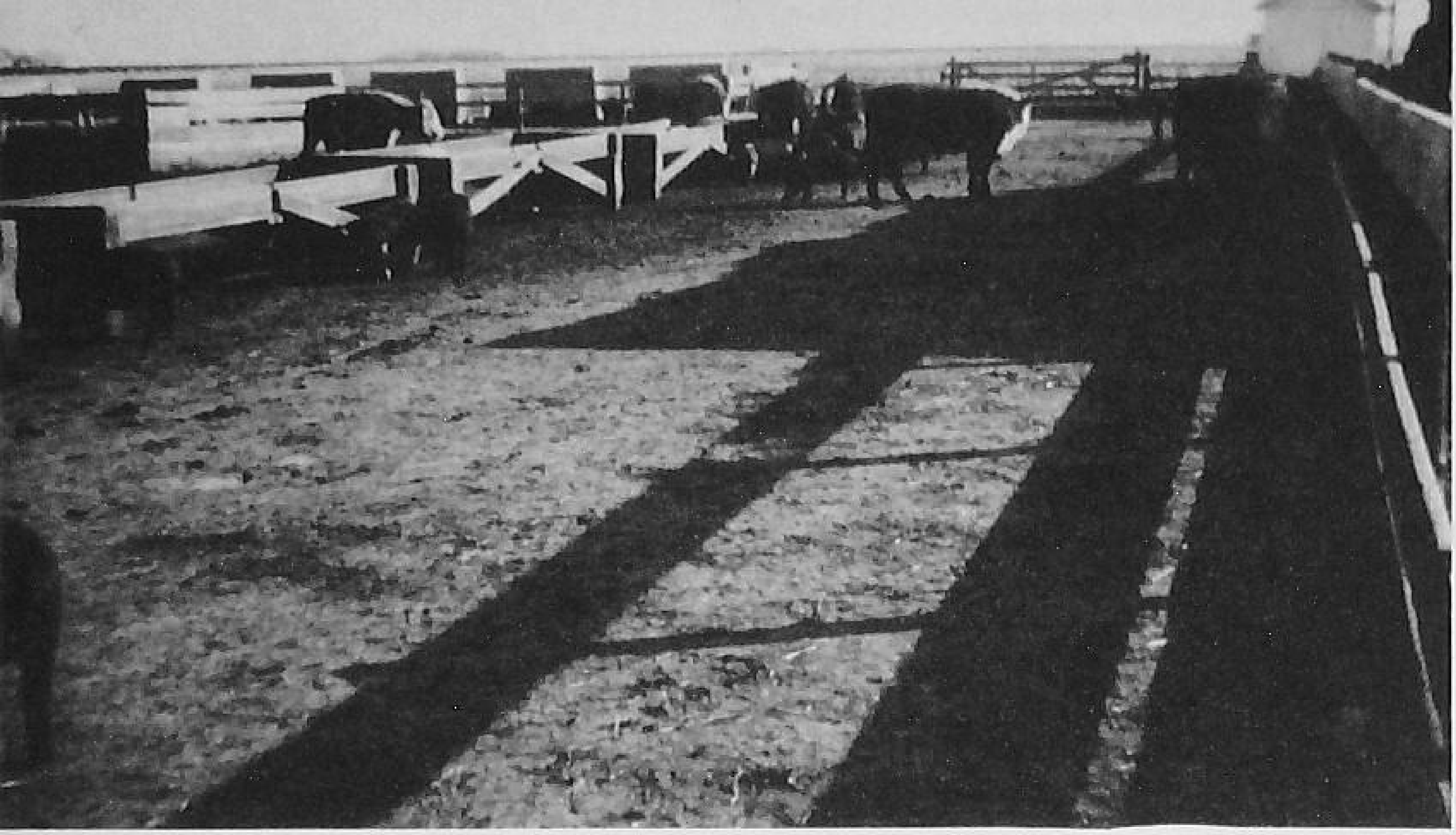
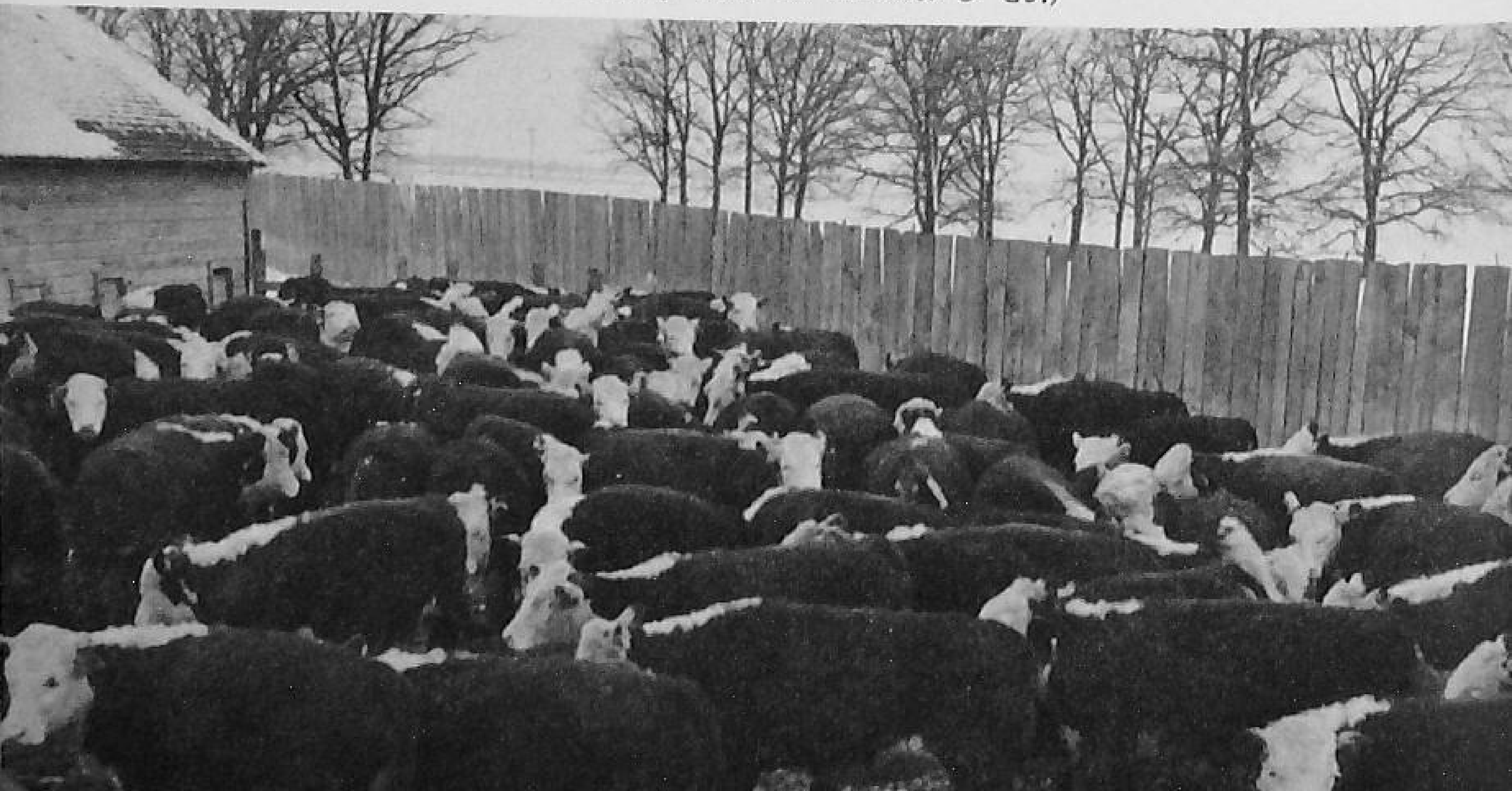


FIGURE 128. *Paved lots keep cattle out of the mud and save manure. (Courtesy Harry Groves.)*

and feed storage facilities (described for the breeding herd) make up the necessary equipment for the cattle feeder. Feed lot fences need to be strong. A good fence can be made by combining plank and woven wire, with the posts set not more than ten feet apart. Cattle confined to small lots subject fences to considerable punishment. During warm weather, shade that will give protection from the sun will add to the comfort of cattle and increase gains.

FIGURE 129. *A high board fence will provide protection against winter winds. (Courtesy Geo. A. Hormel & Co.)*



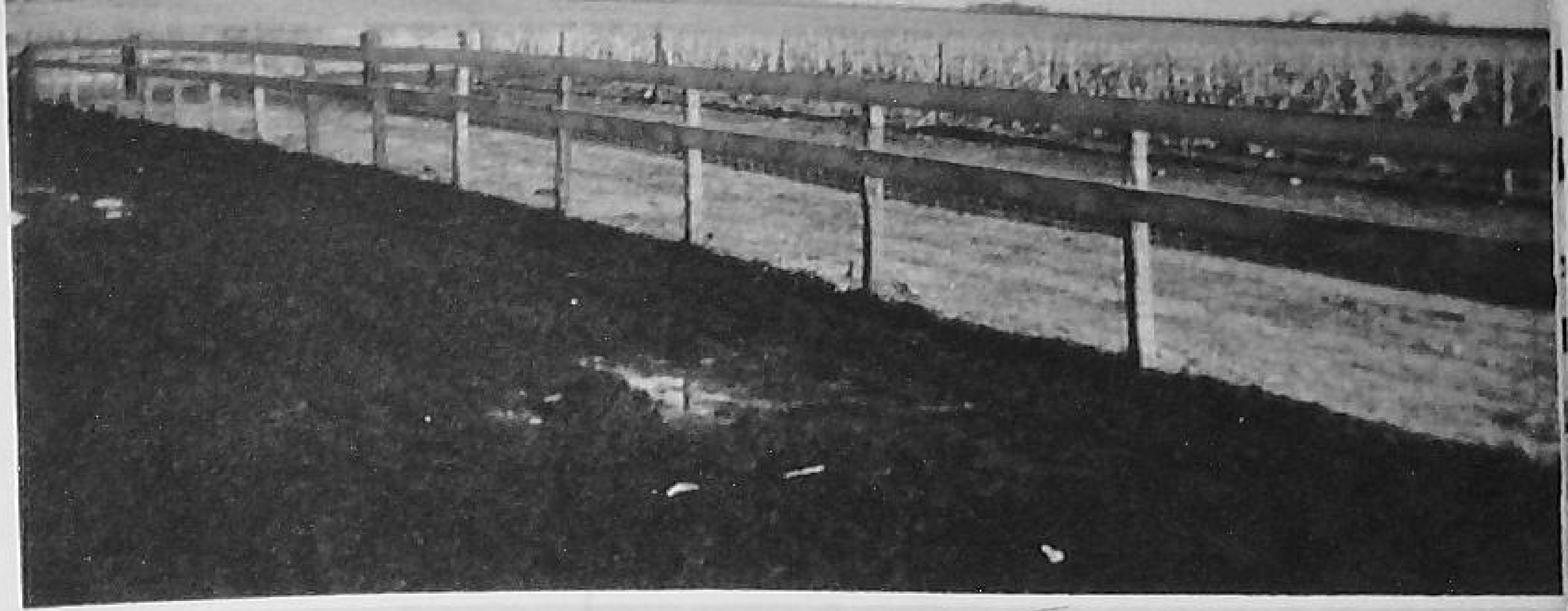
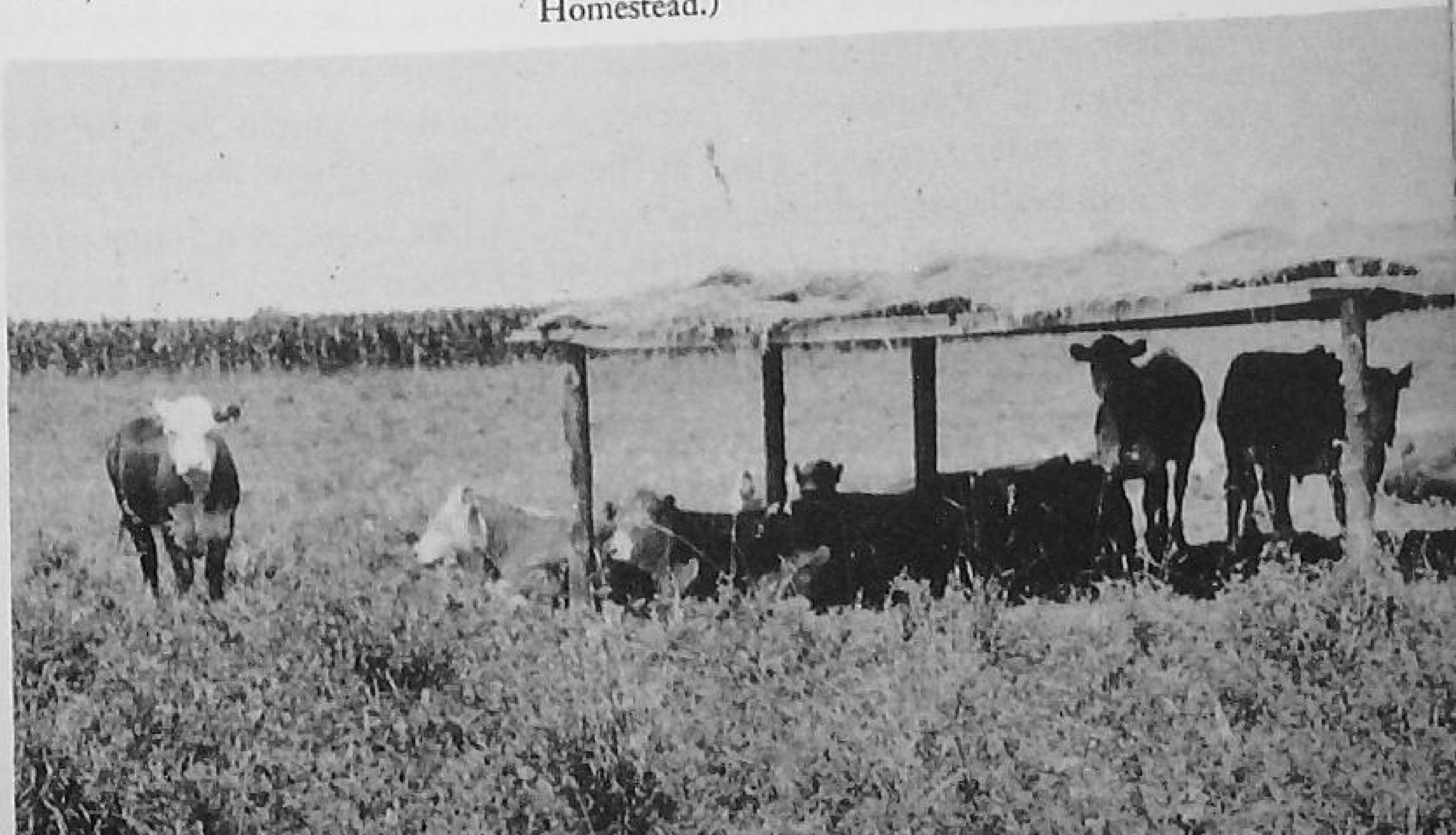


FIGURE 130. *(upper) A good cattle lot fence. (Courtesy Harry Groves.)*

FIGURE 131. *(lower) A cattle shed that may be used to shelter fattening cattle or the breeding herd. (Courtesy Harry Groves.)*

FIGURE 132. *(below) When cattle are on pasture they should have some protection from the heat. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



SUMMARY

Feeder cattle may be raised or purchased from ranchers. Feeders buy and feed cattle for the purpose of making a profit, either on the margin they receive, or by increasing the market value of the feed by selling it in the form of beef.

Two common systems of fattening cattle are practiced by feeders: (1) fattening on grass and (2) fattening in the dry lot. When plenty of pasture is available, it may be utilized by using pasture instead of dry roughages. Pasture usually cheapens gain but does not produce such a high quality of beef as the second system. When the dry lot method is used, costs are greater but gains are faster and carcass grades are generally higher.

Cattle should be given ample time to rest, if shipped from some distant point, before grain feeding is started. In starting cattle on feed, a small amount of the concentrate mixture should be fed at the start and gradually increased until they are on full feed.

A large variety of roughages and concentrates may be successfully used in fattening cattle. Low quality forages, such as cobs and cornstalks, should be supplemented with a good protein feed reinforced with vitamins and minerals. Such high energy feeds as grains or molasses ought to be fed with cobs and cornstalks to increase their digestibility.

Soybean oil meal, linseed oil meal, and cottonseed meal are the chief protein supplements used in fattening cattle. Urea, which is a nitrogen product, may be used to replace part of the protein in the rations. Urea is converted into protein by the microorganisms present in the stomach of cattle. Since urea has no energy value, additional amounts of corn or molasses should be used when urea is fed.

When an abundance of pasture is available, cattle may be fed on it in order to utilize grass as the chief roughage. Pasture feeding reduces labor and cheapens feed cost but requires a longer fattening period and generally does not produce such a high quality of beef as dry lot fattening. Legume-grass mixtures have produced better gains and greater carrying capacity than either one alone.

Feeders to be wintered and turned on grass in the spring should be fed to gain from one to one and one-half pounds per day. This rate of gain is considered a normal growth gain.

Big, thin cattle make more rapid gains than calves or yearlings,

but the younger cattle make greater gains in proportion to feed consumed. As cattle fatten, the amount of feed required to produce 100 pound gain increases. Efficiency of gain is important in deciding whether to feed for choice or prime grades.

Equipment needs for fattening cattle need not be expensive. Protection against storms is all that is needed for housing; strong feed bunks and racks are important; fences should be strong and well constructed; and paved lots save manure and keep the cattle out of the mud.

QUESTIONS

1. Explain how the cattle feeder may profit from his feeding operations.
2. Under what conditions would you fatten cattle on pasture? Dry lot?
3. What are some advantages and disadvantages of pasture fattening?
4. Explain how you would start cattle on feed.
5. Why are legumes considered the best roughages from a nutritive standpoint?
6. Under what conditions may corncobs or corn stalks be used as roughages for fattening cattle?
7. Explain how cattle are able to digest high fiber roughages.
8. What are the chief protein supplements used for cattle?
9. How can urea be used to replace part of the protein?
10. What precautions are necessary in feeding urea?
11. What are the chief fattening grains?
12. Make up several rations using both good and poor roughages, various grains, proteins, and urea.
13. Give several rations that may be used for wintering cattle.
14. What are some of the factors that influence rate and efficiency of gain?
15. List essential beef feeding equipment.

REFERENCES

Animal Husbandry Staff, *Beef Cattle Investigations in Texas, 1899–1950*, Texas A & M, Agricultural Experiment Station, Bulletin, 724, College Station, Texas.

Beeson, W. M., and Perry, T. W., *Answers to Questions on "Purdue Cattle Supplement A,"* Purdue University, Agricultural Experiment Station, Mimeo. AH-93, Lafayette, Indiana.

———, *Wintering Cattle on Corn Cobs*, Purdue University, Agricultural Experiment Station, Mimeo. AH-48, Lafayette, Indiana.

Beresford, Rex, *151 Questions on Cattle Feeding and Marketing*, Iowa State College Extension Service Bulletin 99, Ames, Iowa.

Burroughs, Wise, Culbertson, C. C., Ruf, Edward, Repp, Ward, and Hammond, W. E., *Cattle Supplements Using Corn Stalks, Corncobs, and Hay In Fattening Rations For Yearling Steers*, Iowa State College, Agricultural Experiment Station leaflet 182, Ames, Iowa.

Mayo, Henry, and Anderson, W. T., *Using Pastures for Growing and Fattening Steers*. Lafayette, Indiana, Agricultural Experiment Station, Mimeo. AH-76.

Quayle, W. L., and Paules, Leon H., *Fattening Cattle on Wyoming Feeds*, University of Wyoming, Agricultural Experiment Station, Bulletin 308, Laramie, Wyoming.

< 15 >

Marketing Beef Cattle

The farmers, ranchers, and feeders who have produced cattle for the market are very much concerned over the price they receive for their product. The market price, at the time of sale, is largely responsible in determining whether the enterprise is profitable. Season, grade, market, transportation, and shrinkage are important factors in determining the net price the producer receives for his cattle.

MARKETING FEEDER CATTLE

The producer of feeder cattle depends largely upon the farmers in the grain producing areas for his market. It is equally true that farmers who make a business of fattening cattle are dependent upon producers for cattle to fill their feed yards. The methods whereby the producer and feeder get together are important to both.

Direct Buying and Selling. In recent years there has been an increase in the number of sales made by ranchers directly to the feeder. Such sales are generally made on the ranch. Feeders make the purchases either by contract in advance of delivery date or take the cattle immediately after sale.

Contract sales. When cattle are contracted for, an agreement is made between the buyer and seller. The important provisions in the contract are: (1) *Price.* Price involves the amount paid down to seal the bargain and the final amount at the time cattle are removed from the farm or ranch. (2) *Time and place of delivery.* If the ranch is equipped with scales and loading facilities the cattle may be taken directly from the range by the buyer, otherwise the seller usually agrees to deliver the cattle to a certain point for loading and weighing. (3) *The per cent of shrinkage to be allowed.* When cattle are moved for any distance or handled ex-

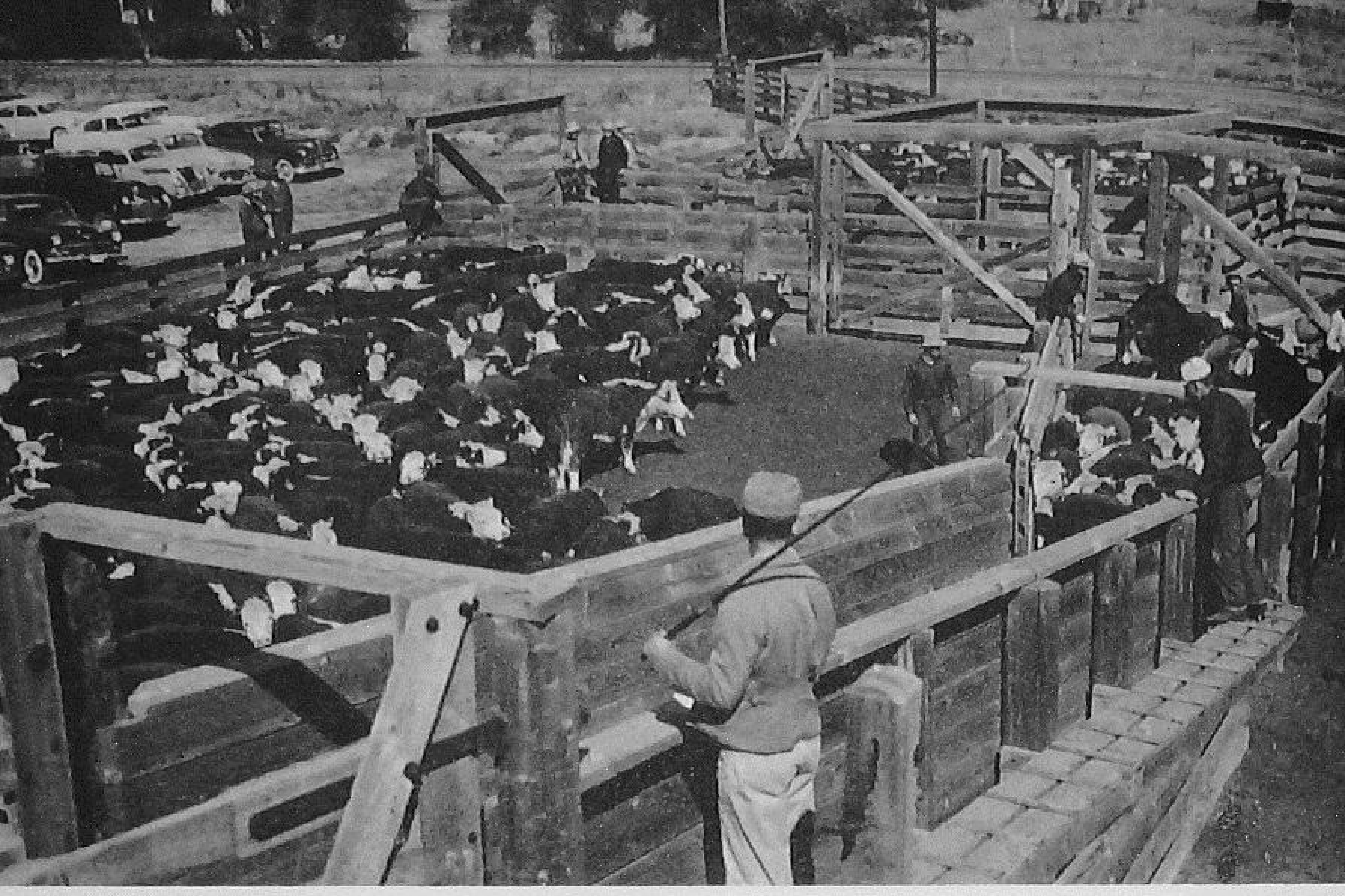


FIGURE 133. *A rural concentration point in western United States. (Courtesy Union Pacific Railroad.)*

tensively, a certain amount of body weight is lost, resulting largely from the feed and water the animal eliminates that is not being replaced by regular feeding and watering. The amount of shrinkage depends upon the time in transit, weather conditions, the length of time cattle are allowed to rest, feed and drink before weighing, and the age and weight of the cattle. No figure can be used that will be accurate enough to determine shrinkage, but 3 per cent is commonly used for feeder cattle.

Direct Selling for Immediate Delivery. Immediate delivery or acceptance of the cattle involves no type of contract. The price is agreed upon as is the amount of shrinkage (if the cattle are moved from the ranch for weighing), settlement is made, and the ownership of the cattle is transferred from seller to buyer within a short time.

Advantages of Direct Dealing. The chief advantage of direct dealing is that it eliminates the middle man and the profit he would necessarily have to make for handling the cattle. Contract sales are usually made for the following reasons: It insures the buyer the cattle that he wants when he wants them. Usually both buyer and seller feel they have made a good price bargain, and both know in advance what the price will be.

FIGURE 134. *The cattle auction is a common method of selling feeder cattle.*

Selling and Buying Through a Dealer. Cattle dealers are individuals or companies that make a business of buying cattle for the feeders. The dealers either buy on a commission basis or depend, for their profit, on reselling the cattle at a higher figure than the cost. Many times small operators can get their cattle cheaper through a dealer than if they spent the time and money necessary to inspect and buy their own cattle.

Auction Sales. Auction sales are a common method of transferring cattle from producer to feeder. Most auctions are private or

FIGURE 135. *A large terminal market. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

company owned. The selling service is paid for by a commission (which is usually paid by the seller) charged on a percentage of the selling price.

Terminal Markets. Large terminal feeder cattle markets are located in many western and midwestern cities. Producers who sell through these markets may consign them to a commission firm that will sell on a commission, or they may sell direct to the buyers. If shipped to a commission firm, selling experts will handle and dispose of the cattle for the owner. They sort mixed grades into uniform lots and see that the cattle are properly cared for and sold to the highest bidder. The cost of yardage, feed, insurance, and selling charges is deducted, and the balance is paid to the owner.

Some of the large feeder cattle markets are the areas of Kansas City, Missouri; Sioux City, Iowa; Omaha, Nebraska; Denver, Colorado; San Antonio, Texas; Oklahoma City, Oklahoma; South St. Paul, Minnesota; Wichita, Kansas; and St. Louis, Missouri.

Selecting a Method of Marketing. The important factor in selecting the method of marketing is the determining of which method will bring the greatest net income. The highest price per hundred weight may not result in the most net profit. If the market is located a great distance from where the cattle were produced, transportation cost and shrinkage will be high. The selling price will have to be proportionately higher to offset these factors. Also there are other costs, such as commissions, yardage, and so forth. The wise operator, in attempting to determine what his cattle will bring at home, will get market information from other prospective markets and estimate shrinkage and other cost before finally deciding the method of marketing he will use.

Season. The majority of feeder cattle are sold during September, October, and November—the fall months that correspond with the end of the grass season. Producers generally desire to cut down on their herds and avoid the necessity of making arrangements for the increased feed supplies for wintering the extra cattle. Because of the heavy movement of feeder cattle in the fall, market prices usually are lower. From the buyer's standpoint fall is a good time to buy. Even though prices can be expected to become higher during the remainder of the year, most producers feel that the cost of additional feed plus the danger of loss from storms or loss from overcrowding of shelters is too great to be compensated

for by the rise in price. When cheap feed and adequate protection are available, cattle carried over until spring often pay good dividends.

Information That Is Helpful in Determining When to Sell. When shall I sell my cattle is a question every producer is asking. No one can consistently predict the time when the market will be highest. However, a knowledge of certain facts will be helpful.

The Total Number of Cattle. Numbers of cattle as compared to normal will affect the markets. When cattle numbers are high, increased marketing will result, and downward pressure on the market can be expected.

Conditions in the Grain Areas. The corn belt farmer is the principal buyer of feeder cattle. The number he buys will depend upon his feed supply. If crop conditions are good, the producer can expect a heavy demand for feeders. The reverse is true if the crop outlook is unfavorable.

Grass Conditions on the Range. When the range areas are well supplied with moisture, there will be lots of feed. Ranchers are inclined to keep their cattle until late, putting on as much weight as possible before selling. Under good grazing conditions early fall feeder markets are usually high, followed by an exceptional slump with the first general snowfall, at which time feeders pour into the markets.

Employment Conditions. Farmers and ranchers are dependent upon the consumer for their final market. What the average American eats and how much are the factors that determine prices of farm products. Since the largest group of people are the laboring class, their wages and the number employed are important. When the number of unemployed increases, beef and all farm products can be expected to move downward in price.

Sources of Market Information. Market information based on the previously mentioned conditions may be obtained from agricultural colleges, state and federal departments of agriculture, newspapers, magazines, radio and television reports, and private outlook information services.

CLASSIFICATION AND GRADES OF SLAUGHTER CATTLE

The successful marketing of slaughter cattle is determined by feeding for the proper grade, methods of marketing, and the time the producer sells. Slaughter cattle are classified and graded ac-

cording to sex, age, weight, and grade. Table 24 shows the commonly used system of classifying and grading.

TABLE 24

CLASSIFICATION AND GRADES OF SLAUGHTER CATTLE

Sex	*Age*	*Weight*	*Grade*
Steers	Yearlings	Light Medium Heavy	Prime, choice, good, commercial, utility, cutter, canner
	2-year-olds and over	Light Medium Heavy	Prime, choice, good, commercial, utility, cutter, canner
Heifers	Yearlings	Light Medium Heavy	Prime, choice, good, commercial, utility, cutter, canner
	2-year-olds	Light Medium Heavy	Prime, choice, good, commercial, utility, cutter, canner
Cows	All ages	All weights	Choice, good, commercial, utility, cutter, canner
Bulls	Yearlings	All weights	Choice, good, commercial, utility, cutter, canner
	2-year-olds and over	Light Medium Heavy	Choice, good, commercial, utility, cutter, canner
Stags	All ages	All weights	Choice, good, commercial, utility, cutter, canner

The higher grades consist of cattle well-developed in the areas of valuable cuts (back, loin, and hind quarters), and uniformly covered with a high degree of finish. Choice and prime cattle usually are long-time grain fed cattle. They not only cut a high yielding carcass, but it is also one with a clear white firm fat that is well distributed around and through the muscle or lean meat. Young cattle (yearling and two-year-olds) produce the more popular sized cuts and are more tender and flavorful than older cattle. In contrast to older and lower grade animals, young prime cattle usually are sold at premium prices. The carcass yield is important in determining grades. Young prime cattle will dress from 62 to 67 per cent, choice from 60 to 64 per cent, good from 58 to 60 per cent, and medium from 52 to 58 per cent, while cutters and canners will average around 42 per cent.

Length of Feeding Period. The length of the feeding period will depend largely upon the grade of feeders the individual has on

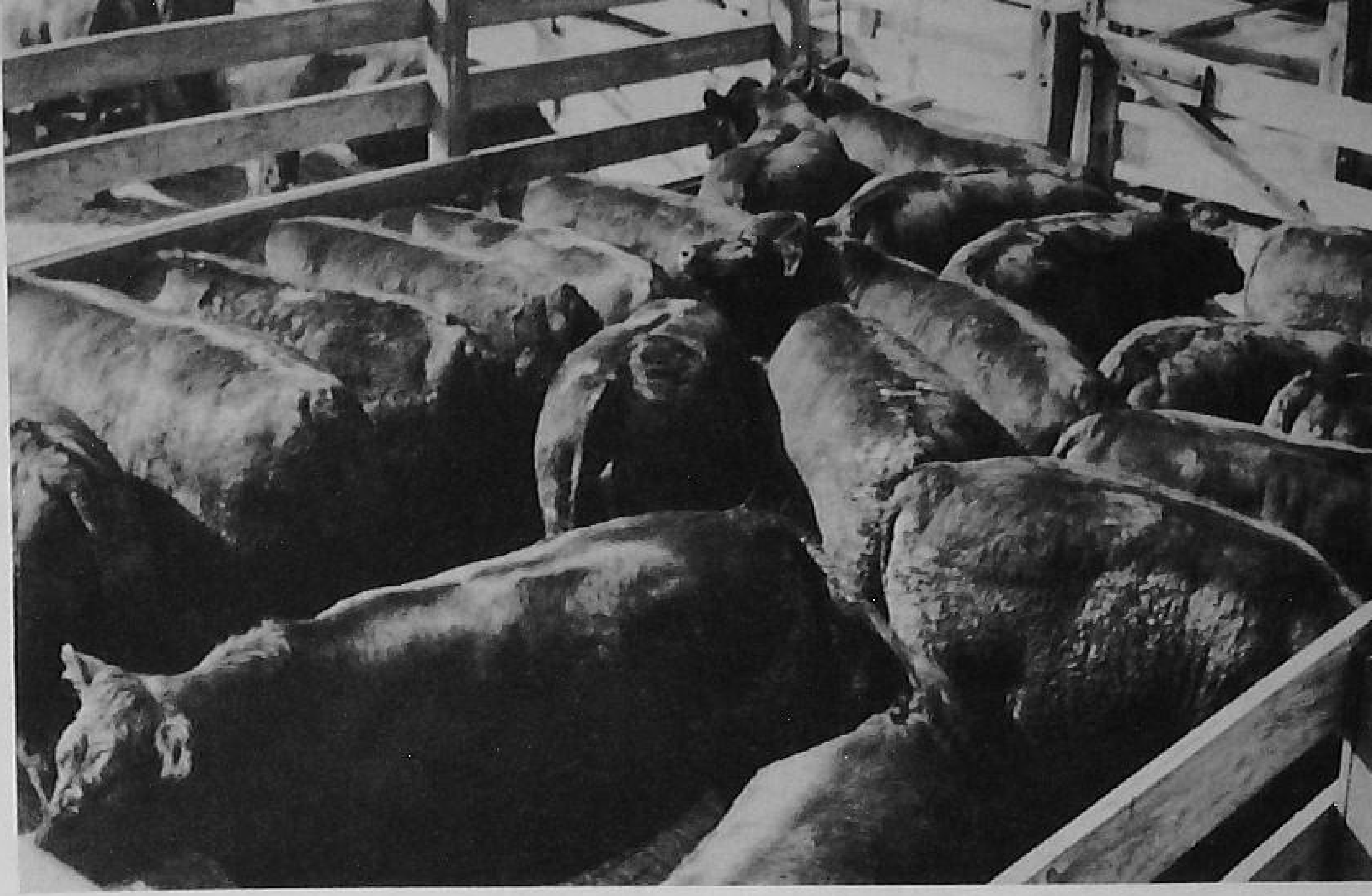


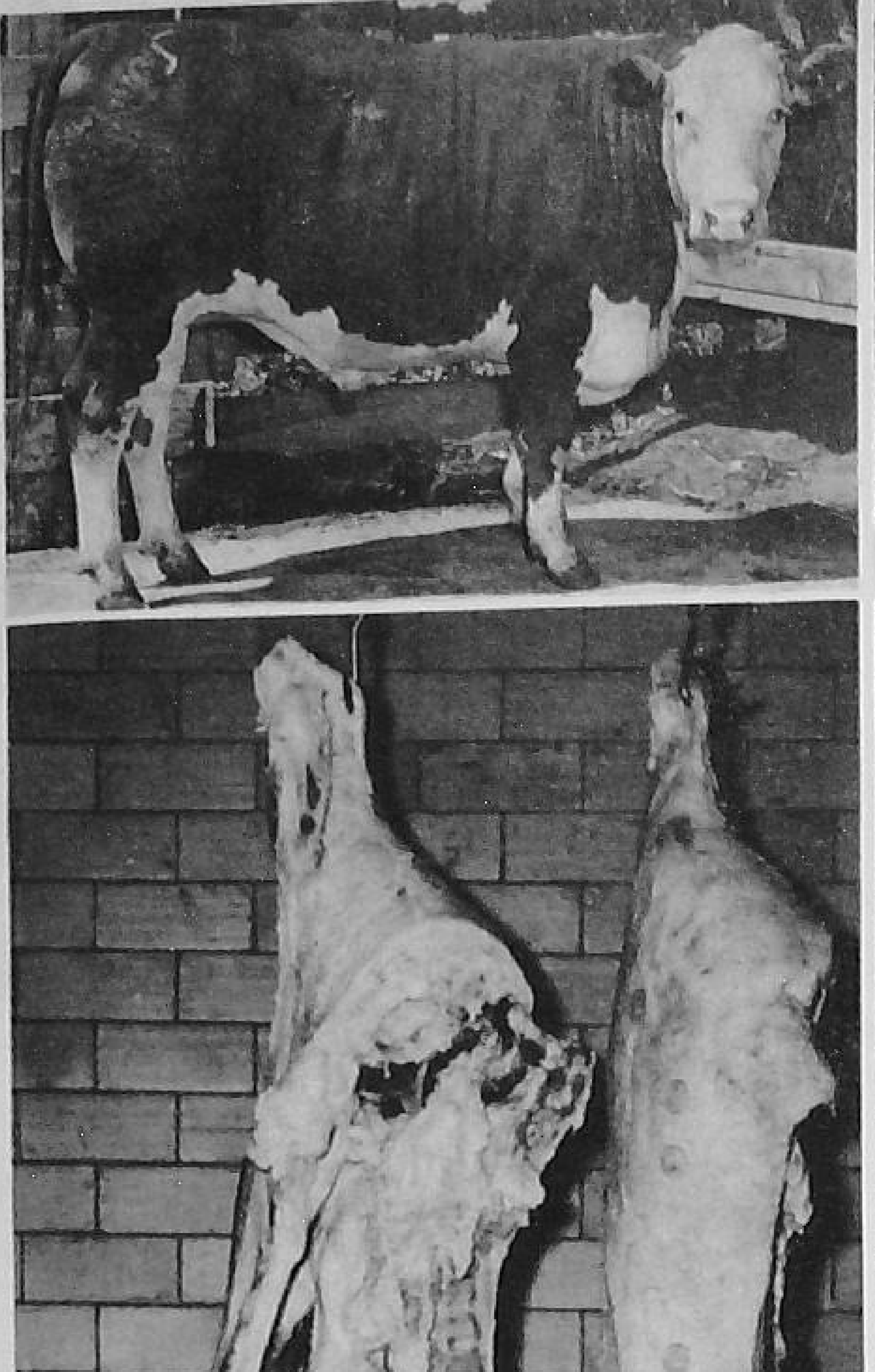
FIGURE 136. *Prime cattle in the yards of a packing plant. (Courtesy Rath Packing Company.)*

feed. High grade slaughter animals are produced from well-bred feeder cattle and by long-time feeding. It is a mistake to feed cattle beyond their grade. Low grade feeders tend to become bunchy and patchy with excess fat. Unless the finish is uniform, extra fat will not improve the grade. The ability to finish uniformly is a matter of breeding. It is essential that the grade of feeders purchased will correspond to the grade desired in the finished cattle. Common grade feeders cannot be expected to grade higher than good grade when finished, whereas good to choice grades should finish as choice and prime beef.

MARKETING SLAUGHTER CATTLE

Types of Marketing Procedure. The feeder may (1) sell cattle directly to the packer or a packer buyer who generally works on a salary paid by the packer he represents, (2) ship to a terminal market and consign to a commission firm, or (3) sell to a private buyer who buys from the feeder and sells to the packer.

Selling to the packer or packer buyer. Many cattle are trucked or shipped directly to the packer. Usually on the day they arrive, they are weighed and paid for at the price being paid for their grade. Most packing companies have buyers in the field who will bid on the cattle at the farm; such bids may be qualified by adding a shrinkage stipulation.



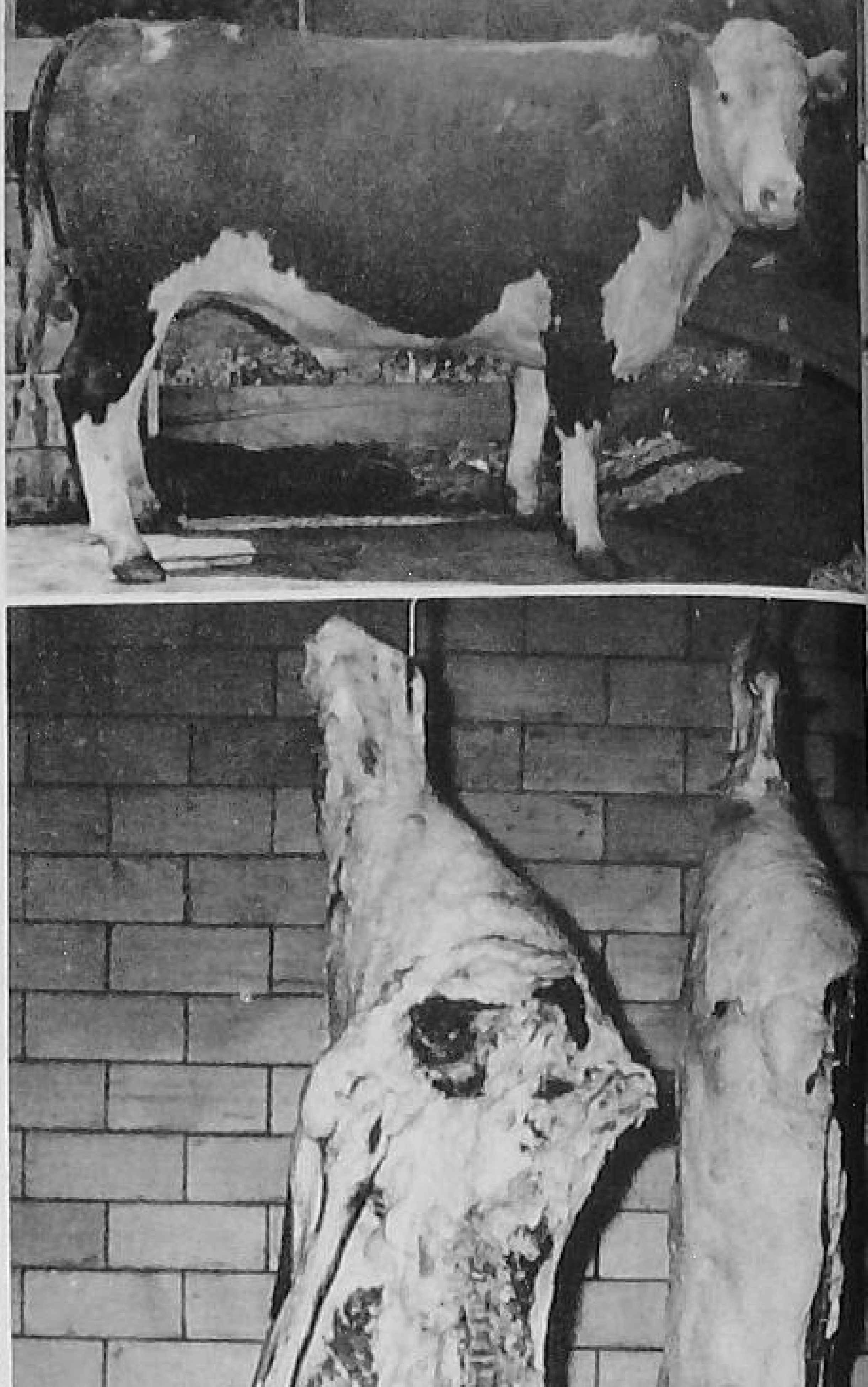
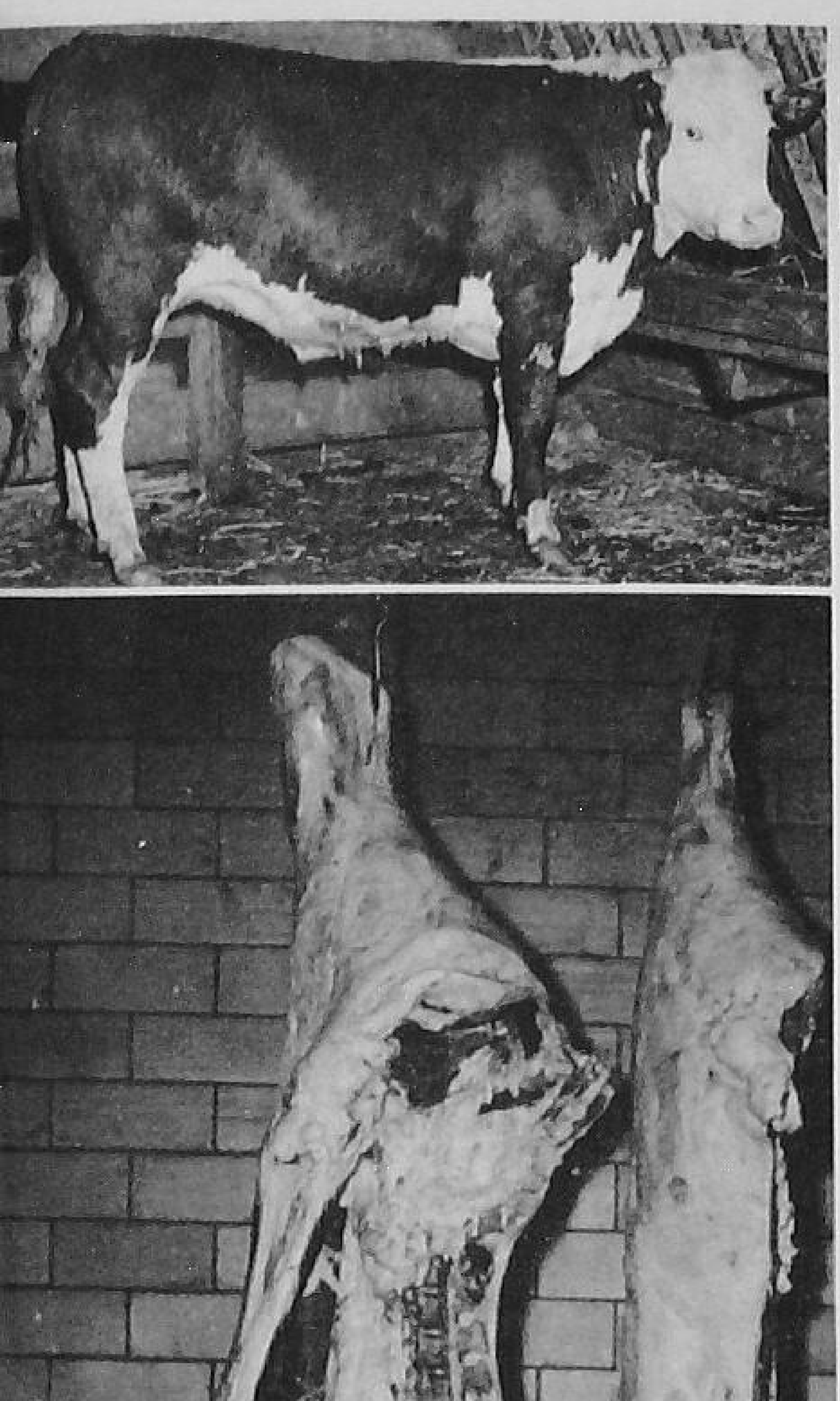


FIGURE 137. *(left, upper and lower) Prime steer and carcass from the same animal. Note the thickness and fullness of the round, the thickness through the loin, and the large amount of clear white fat covering the carcass. (Courtesy Rath Packing Company.)*

FIGURE 138. *(right, upper and lower) A choice beef is good beef but lacks somewhat in finish and development of high-priced cuts as compared to prime beef. (Courtesy Rath Packing Company.)*



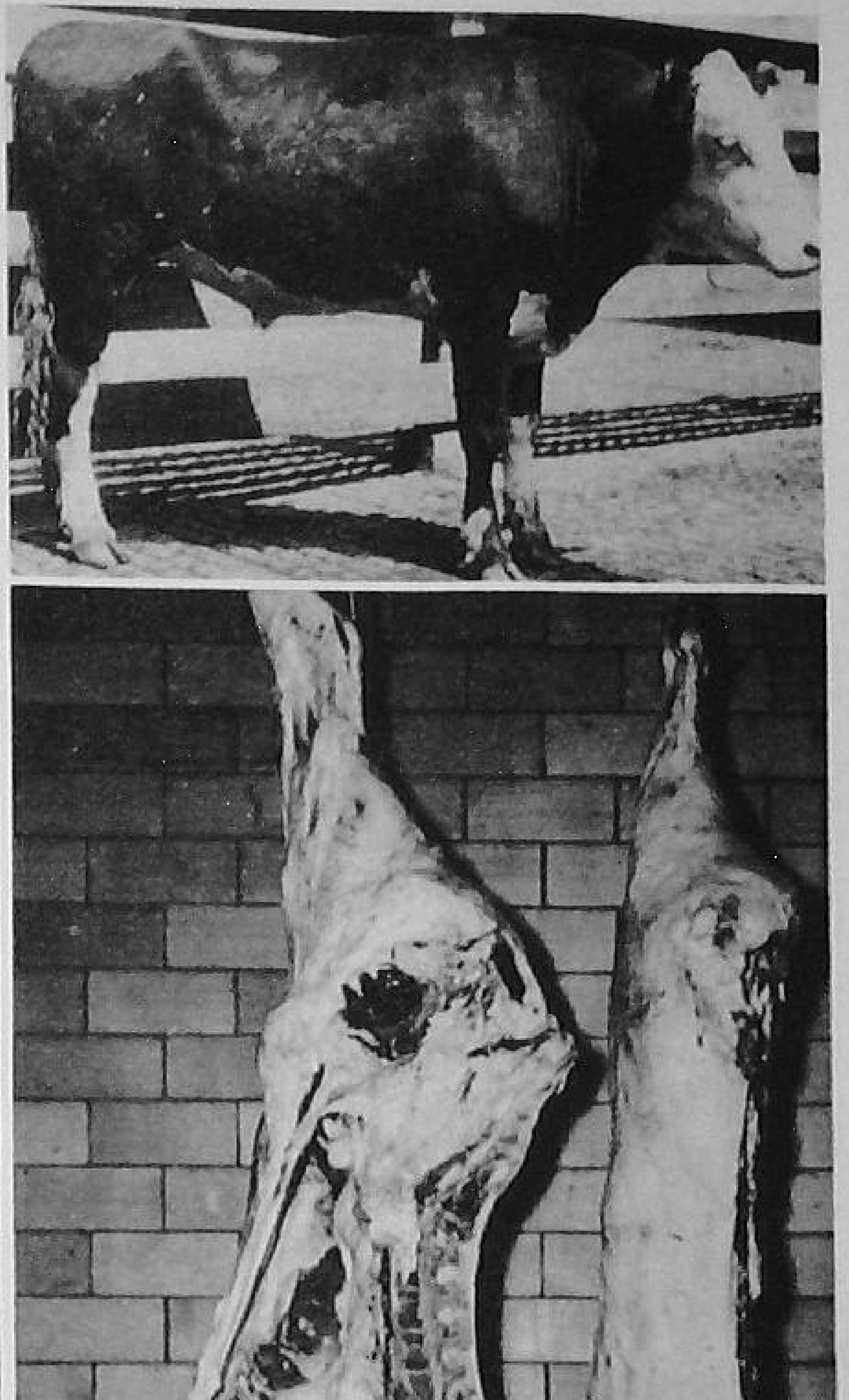
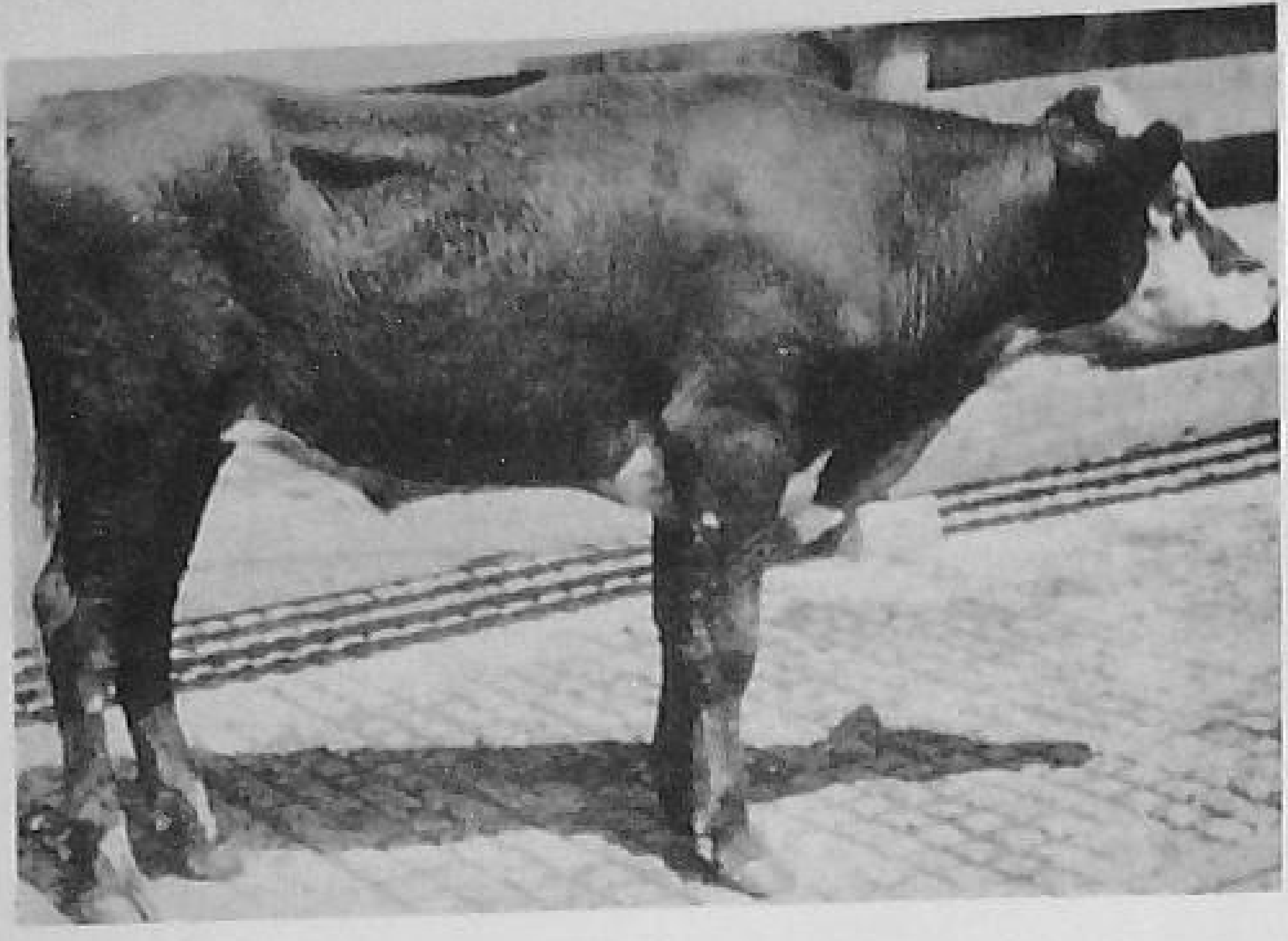


FIGURE 139. *(left, upper and lower) This beef graded good. (Courtesy Rath Packing Company.)*

FIGURE 140. *(right, upper and lower) Commercial grade steer. Note the lack of finish and thickness through the round and loin. (Courtesy Rath Packing Company.)*



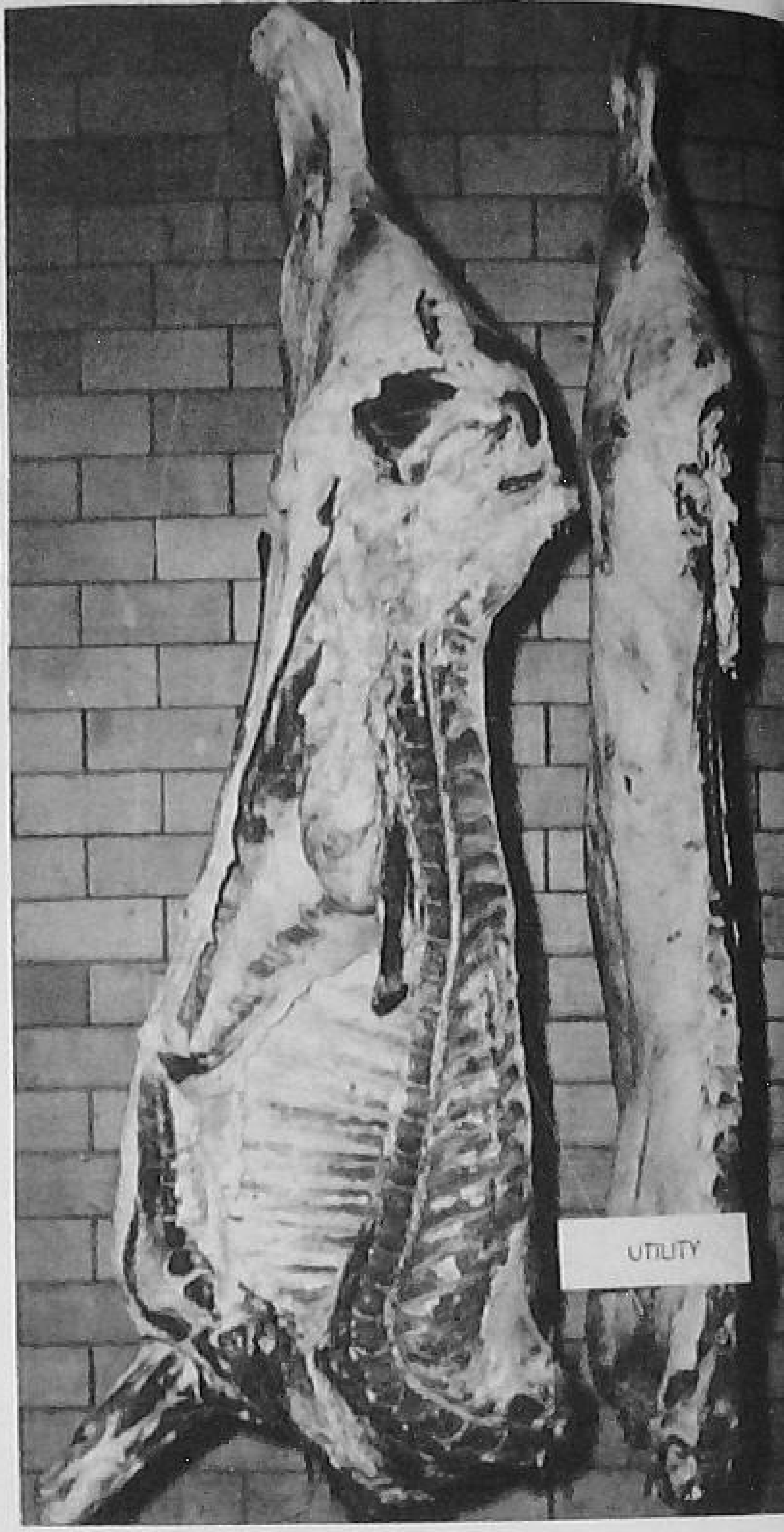
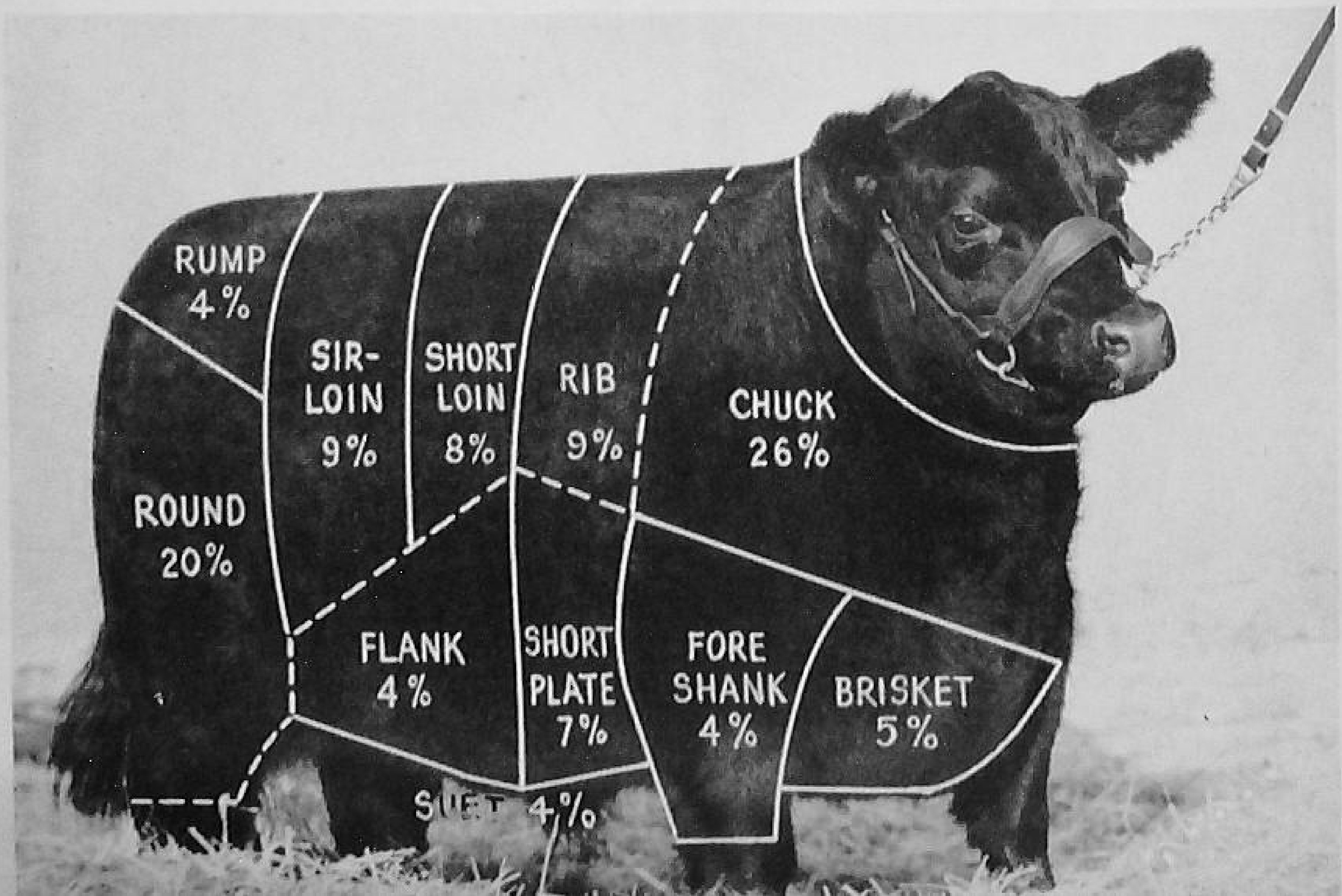


FIGURE 141. *(above and right) Utility grade. Very poor beef. (Courtesy Rath Packing Company.)*

FIGURE 142. *(below) Wholesale cuts of beef. (Abernathy photo. Courtesy of American Aberdeen-Angus Breeders' Association.)*



Selling through commission firms. The large terminal markets have a number of commission firms to whom feeders may consign their cattle. The commission firms handle the cattle in a manner similar to marketing feeder cattle. The cattle are sorted into uniform grades and sold at the highest obtainable price. The yardage cost plus the commission fees are deducted, and the balance is sent to the feeder.

Selling to private buyers. Many communities have private stock buyers who buy cattle and other livestock and send them on to packers. Such buyers offer an outlet for small lots of animals because they generally have yard facilities where they can bunch animals according to grade before shipping or trucking them on to market.

Cooperative Marketing. Various types of cooperative marketing facilities have developed during recent years. Cooperative commission companies have been the principal type of cooperative that has affected beef cattle marketing. The commission companies operate much like the private concerns except the profits are paid to the members in the form of patronage dividends.

INFORMATION NEEDED TO DETERMINE WHEN TO SELL

Seasonal Price Trends. The marketing of slaughter cattle follows a rather definite seasonal pattern, if a period of years is used to determine the pattern. However, so many factors may affect

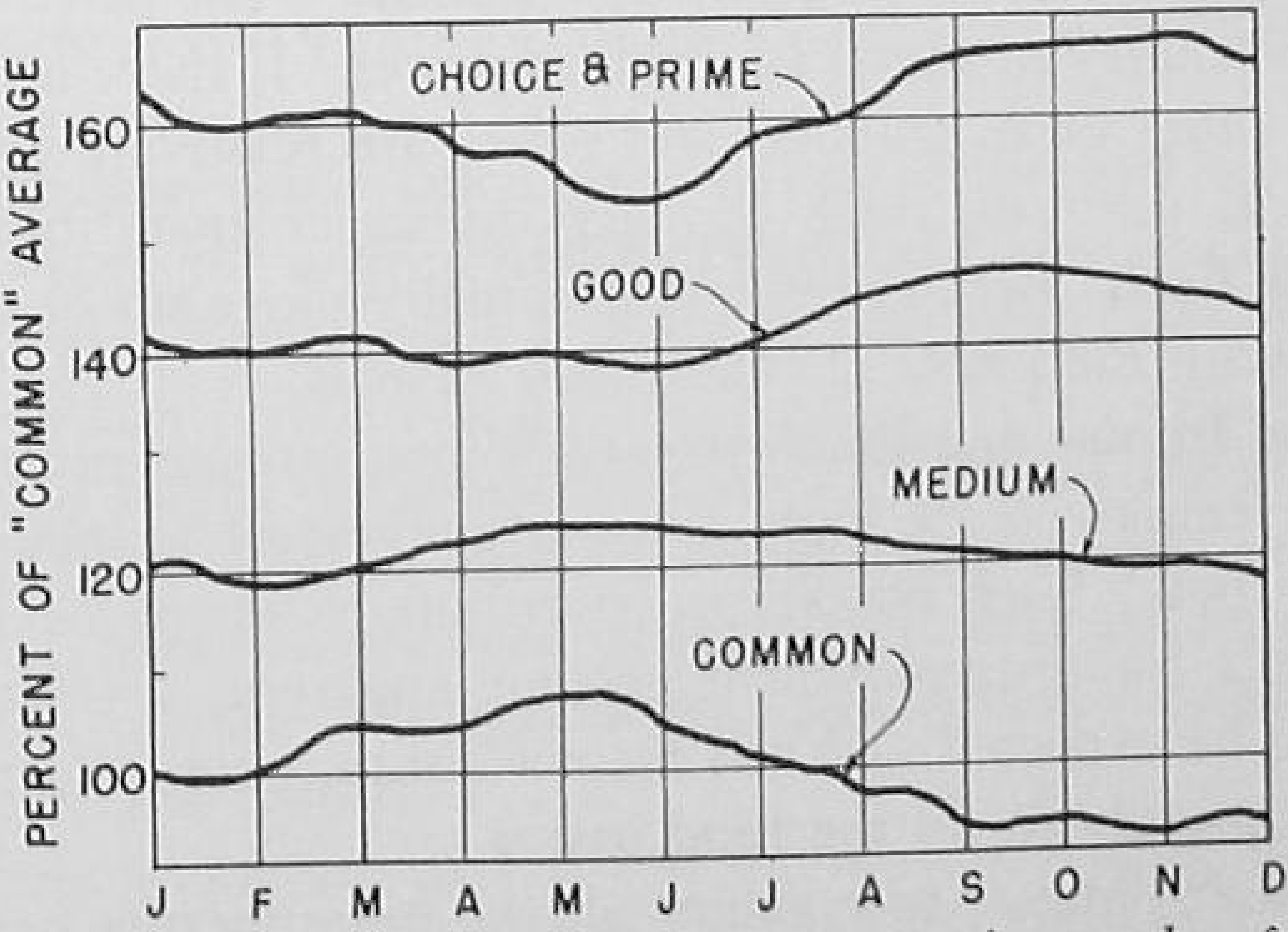


FIGURE 143. *Average seasonal price trends of various grades of beef.*

the marketing for any one year that long time trends cannot be relied upon as a means of determining when to sell.

Like the marketing of feeder cattle, certain types of information (that may be secured from the same agencies previously listed under feeder cattle marketing) will help to determine when to sell slaughter cattle.

Feed Situation. The amount and kind of feed available over the general cattle feeding areas are probably the most important consideration in selecting a time to sell. When the feed grain crops have been abundant and quality is good, the tendency is for long feeding periods. The peak marketing period will be delayed, and the price drop may come later than usual. If the corn belt has a soft corn crop, there will be a rush for feeder cattle to consume the corn. Since soft corn will not keep when warm weather arrives, it is important to buy enough cattle to consume the feed quickly. Under such conditions the heavy movement of cattle will likely be earlier than normal with the price break coming early.

Grade. The grade of cattle is important in selecting the time of marketing. The lower grades usually sell best during the first half of the year (May, June, and July), while the better grades reach a peak during September, October, and November.

Number of Cattle on Feed. The number of cattle on feed is important in determining possible price and time to sell. If the cattle numbers in the feed lot are above the normal, lower prices in general can be expected while short numbers are favorable to strong prices.

Numbers and Prices of Other Meat Animals. The price of pork, lamb, and poultry products affects beef prices. If there is an abundance of other meat products and prices are relatively low, consumers will purchase these products in larger quantities at the expense of beef. Beef prices will eventually move up or down to compete with the prices of other meat animals.

National Income and Employment. When income and numbers of people employed are high, a larger amount of money will be spent for food. Such conditions contribute to strong beef prices. If prospects for unemployment become apparent, a softening of prices can be expected. When income drops, people turn to less expensive sources to fill the food basket.

It is rather difficult to combine all the price factors here listed and arrive at the correct conclusions. No person can expect always to be right. However, if careful consideration is given to the prevailing conditions, one can expect to hit over half of the

time. If his batting average is above 50 per cent, he can expect a profit over a period of years.

LOSSES DUE TO DAMAGED CARCASSES

Losses running into millions of dollars is sustained by the livestock industry as a result of damaged carcasses. Most of this damage could be prevented. Producers are not aware of the personal losses caused by bruises, because such injuries can only be determined after slaughter. Usually the producer has his check by the time the animal is slaughtered and thinks this loss is the packers'. However, packers have learned through experience the per cent of such losses, and they are reflected in the prices bid for live animals. Most bruised carcasses result from horn damage, careless handling, overcrowding, prodding with clubs, and feed lot obstacles.

SUMMARY

Feeder cattle may be bought and sold directly between producer and feeder or from producer to dealer to feeder. Many feeder cattle are sold through auctions or shipped to terminal market and handled by commission firms. When a buyer desires to purchase cattle of a certain kind, he often contracts for the cattle. The producer delivers the cattle according to contract at a later date.

Methods of marketing are determined by the greatest net price after transportation, shrinkage, and other costs have been considered.

Most feeder cattle reach the market at the end of the grass season, which for a large part of the range country is September, October, and November. Usually feeders' prices are lower during this season of the year.

Prices of feeder cattle are determined largely by the numbers of animals, feed condition, and consumer buying power. Market information may be obtained from agricultural colleges, United States Department of Agriculture, newspapers, magazines, and private outlook reports.

Slaughter cattle are graded and classified according to sex, age, weight, and grade. The class and grade are important in determining the price they will bring. Season, national income, numbers on feed, and feed conditions are other factors that determine the price of cattle.

Cattle feeders may market their animals directly to packers or packer buyers, through private or cooperative commission firms at the terminal markets, or to local private buyers. The total net income is the important factor in determining the method and place to sell.

Heavy losses are paid indirectly each year by producers as a result of damaged carcasses caused chiefly by bruises. Dehorning and careful handling of the animals will eliminate much of this loss.

QUESTIONS

1. What are the methods whereby the feeder and producer may buy and sell feeder cattle?
2. What advantages do each of the methods in the above question have?
3. What information will be helpful in determining when to sell feeder cattle?
4. What information should the buyer have?
5. Where can market information be secured?
6. Give the classes and grades of slaughter cattle.
7. What effect does class and grade have on market price?
8. What determines the length of time a group of cattle should be fed? Explain.
9. What information will help the cattle feeder to know when to sell?
10. How can bruises on carcasses be reduced?

REFERENCES

Hamilton, Eugene, *Seasonal Market Variations and Their Importance to the Iowa Farmers*, Iowa State College, Agricultural Experiment Station and Extension Service, Bulletin P 5, Ames, Iowa.

Malone, Carl C., *Making Your Farm Pay*, Iowa State College Press, Ames, Iowa, 1951.

Marketing Feeder Cattle and Sheep in the North Central Region, University of Nebraska, Agricultural Experiment Station, Bulletin 410, Lincoln, Nebraska.

Potter, E. L., *The Marketing of Oregon Livestock*, Oregon State College, Agricultural Experiment Station, Bulletin 514, Cornvallis, Oregon.

Stevens, I. M., Burdick, R. T., Mason, H. G., and Gazaway, H. P., *Marketing Western Feeder Cattle*, University of Wyoming, Agricultural Experiment Station, Bulletin 317, Laramie, Wyoming.

Profitable Production of Dairy Products

< 16 >

The Dairy Production Industry

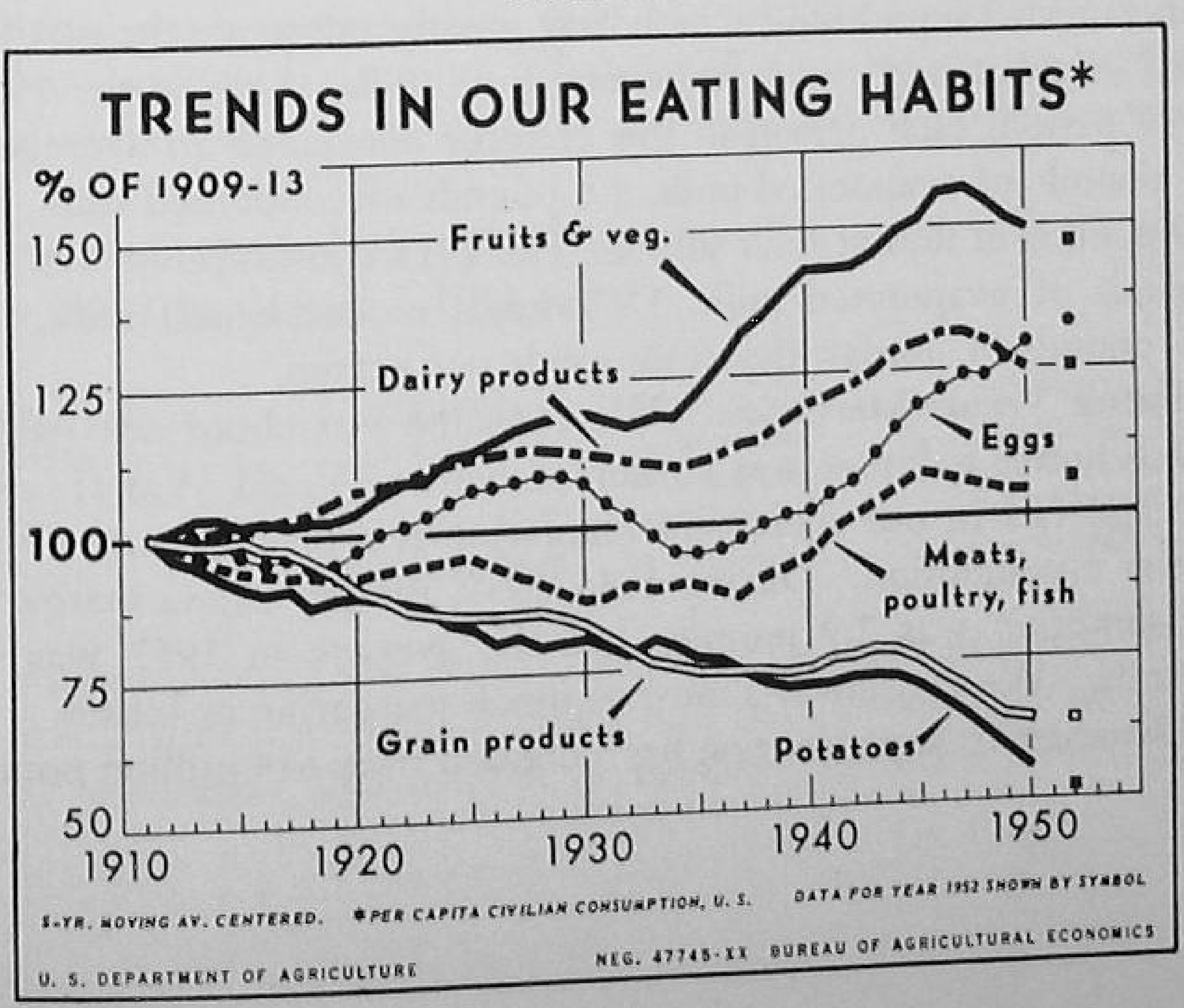
The production of dairy products in this nation is big business. Dairy cattle are kept on about 50 per cent of the farms, and in 1951 provided 13.2 per cent of our nation's cash farm income. The income from the sale of dairy products was larger than the income from hog sales, and than the income from poultry and sheep sales combined.

Milk and milk products, bread, and eggs are universally used human foods. Milk has an important place in the American diet. It is palatable and nutritious. It contains most of the food nutrients needed by humans and by young animals.

CONSUMPTION OF DAIRY PRODUCTS

When our grandfathers were boys, cows were used to supply the family with milk and butter. Occasionally, the milk and cream were used in making ice cream and cheese. The develop-

FIGURE 144.



ment of refrigeration, pasteurization, homogenization, and scientific methods of producing and processing milk and milk products have made it possible for us to make more effective use of these products.

In 1924 the average person consumed 17.8 pounds of butter, 4.5 pounds of cheese, and 6.8 quarts of ice cream. The average consumption per person in 1951 was 9.7 pounds of butter, 7.2 pounds of cheese, and 14 quarts of ice cream.

TABLE 25

U. S. PER CAPITA CONSUMPTION OF DAIRY PRODUCTS *

Year	*Butter* (*lbs.*)	*Cheese* (*lbs.*)	*Ice Cream* (*qts.*)
1924	17.8	4.5	6.8
1930	17.2	4.6	7.6
1936	16.4	5.3	7.6
1942	15.8	6.4	13.6
1948	10.0	6.9	15.2
1951	9.7	7.2	14.0

* *Milk Facts,* Milk Industry Foundation.

The average consumption of butter has decreased yearly since 1924, and the consumption of cheese and ice cream has increased.

Fluid Milk and Cream. In 1925 the per capita consumption of fluid milk and cream was 353.5 pounds, whereas the consumption at the close of World War II in 1945 was 425.0 pounds. Milk and cream consumption has increased about 20 per cent since 1940.

Evaporated, Condensed, and Dry Milk Solids. The consumption of these products has not been large, but there has been some increase during recent years. Some processors are now marketing a concentrated liquid milk which may greatly influence the methods used in processing and transporting fluid milk. During the 1935–1939 period, each person in this country consumed an average of 15 pounds of evaporated milk, 1.6 pounds of condensed milk, and 1.9 pounds of nonfat milk solids. The 1952 consumption was 16.3 pounds of evaporated milk, 1.9 pounds of condensed milk, and 4.3 pounds of nonfat, dry milk solids per person.

Butter Versus Margarine. We consume just about one-half as much butter today as was consumed before World War II. We use less fats in our diets, and margarine is replacing part of the butter consumption. During 1935–1939, the per capita margarine consumption was 2.9 pounds, but the average in 1952 was 7.7 pounds. We consumed almost as much margarine as butter.

Oleomargarine production has increased from 614 million pounds

produced in 1945 to 1,036.7 million pounds produced in 1951. Margarine sold in 1953 for about two-fifths the price of butter.

UTILIZATION OF MILK

The changes in consumption of dairy products have been influential in the methods used in processing milk and in the emphasis placed upon the butterfat content of milk. The butterfat content is becoming less important in milk production.

Shown in Table 26 are the changes which have come about in the use of the milk produced in this country since 1925.

TABLE 26

UTILIZATION OF MILK IN MAJOR CHANNELS *
(Expressed as Percentages of Total)

Year	*Butter*	*Cheese*	*Condensed and Evaporated Milk*	*Dry Whole Milk*	*Ice Cream (milk used)*	*Other Including Fluid and Cream*	*Total Human Utilization*
1925	47.7	5.7	3.8	0.1	2.9	39.8	100
1935	44.2	6.3	4.5	0.2	2.4	42.4	100
1945	29.2	9.5	7.7	1.4	4.4	47.8	100
1950	29.1	10.5	6.1	.8	5.8	47.7	100
1952 †	25.1	10.3	5.9	.6	6.5	51.6	100

* U.S.D.A., Bureau of Dairy Industry.
† Preliminary.

PRODUCTION OF DAIRY PRODUCTS

With the exception of a few years during the drought, cow numbers increased in this country until 1944. Since that time the number of cows has decreased from nearly 26 million in 1944 to 23.9 million by January, 1953. Production of dairy products has increased even more rapidly than cow numbers, because of increased production per cow. Shown in Figure 145 are the changes which have come about in cow numbers and in production per cow from 1910 to 1948.

Leading States in Dairy Cow Numbers. The states with the most dairy cows by January, 1953 were:

1. Wisconsin ....2,504,000 head
2. Minnesota ....1,454,000 head
3. New York ....1,439,000 head
4. Iowa ....1,145,000 head
5. Texas ....1,085,000 head
6. Ohio ....1,019,000 head
7. Missouri ....1,014,000 head
8. Pennsylvania .... 989,000 head
9. Michigan .... 963,000 head
10. Illinois .... 931,000 head

Cow numbers in the South Atlantic States increased from 1935 to 1950 by nearly 100,000 cows, and milk production per cow nearly doubled. The number of cows in the West North Cen-

MILK: NUMBER OF COWS MILKED, AND PRODUCTION PER COW MILKED ON FARMS, UNITED STATES, 1909-48

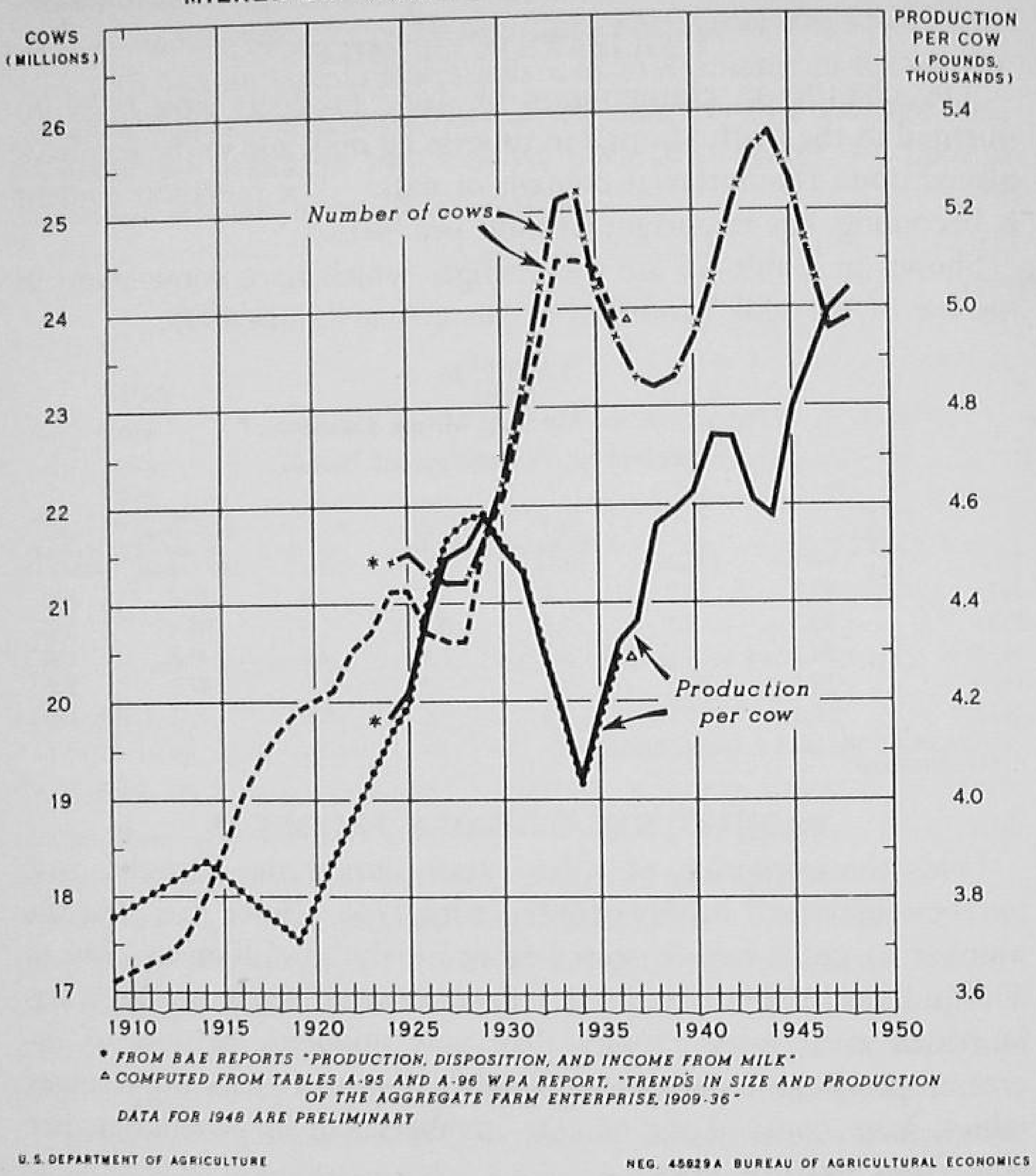


FIGURE 145.

tral states has been decreasing rapidly. Nearly 50 per cent of the dairy cows in the nation by January, 1953 were in the North Central states. Twenty per cent were in the South Central states, 14 per cent were in the North Atlantic states, and 8 per cent were in each, the South Atlantic and Western states.

In 1924 there was roughly one cow per every five persons in this nation. There was one cow to seven or eight persons in 1952. Our population increased about 40 per cent between 1924 and 1952, but milk production increased only 28 per cent.

The demand for milk and milk products in the future is bright. Our national population is increasing at the rate of about 2.5 million persons per year. We will need 112 to 113 million gallons of milk each year just to feed the increase in population.

Average Milk Production Per Cow. According to the Bureau of Agricultural Economics, the average cow in the United States in 1952 produced 5290 pounds of milk and 211 pounds of butterfat. The high states in average production of milk per cow in 1951 were: California, 7700 lbs.; New Jersey, 7510 lbs.; Rhode Island, 7280 lbs.; Wisconsin, 7010 lbs.; and New York with 6820 pounds per cow.

Production of cows in Dairy Herd Improvement Association herds. By January, 1953 there were 1,226,588 cows on test in the 2151 dairy herd improvement associations in the United States. These cows represented 40,983 herds and about 5 per cent of all dairy cows in the nation.

In 1906 there were 239 cows on test which produced an average of 5430 pounds of milk and 215 pounds of butterfat. In 1951 there were 1,086,615 cows on test which produced an average of 9195 pounds of milk and 370 pounds of butterfat.

TABLE 27

AVERAGE PRODUCTION OF COWS IN DAIRY HERD IMPROVEMENT ASSOCIATIONS, 1906–1951 *

Year	*Cows on Test (number)*	*Average Milk (pounds)*	*Production Butterfat (pounds)*
1906	239	5430	215
1910	25,000 †	5730 †	227 †
1920	203,472	6241	247
1930	507,549	7642	303
1940	676,141	8133	331
1950	1,088,872	9172	370
1951	1,086,615	9195	370

* U.S.D.A., Bureau of Dairy Industry.
† Estimated.

The cows in the association herds in 1906 produced approximately the same quantity of milk and butter produced by the average cow in the nation in 1952. There is plenty of room for improvement of dairy production on the average farm.

Creamery Butter Production. Although only about 25 per cent of the milk produced in this country is used in making butter, the industry is very important in some states. Minnesota produced, in 1950, 251 million pounds of butter; Iowa produced 199 million

FIGURE 146. *A specialized dairy farm. (Strohmeyer & Carpenter photo. Courtesy American Jersey Cattle Club.)*

pounds; and Wisconsin produced 161 million pounds. These three states produced nearly 50 per cent of the 1386 million pounds of butter produced in 1950.

Cheese Production. About 10 per cent of the milk produced in 1950 was used in the production of American cheese. Wisconsin was responsible for nearly 50 per cent of the 1950 cheese production. Wisconsin produced 418 million pounds; Missouri, 63 million pounds; Minnesota, 45 million pounds; and Illinois produced 45 million pounds. The nation's production in 1950 was 892 million pounds.

Ice Cream Production. The consumption of ice cream has nearly doubled since 1935. Approximately 6.5 per cent of the milk produced in this country in 1952 was used in the ice cream production. Pennsylvania led all states in ice cream production in 1950 with 66 million gallons. New York ranked second with 59 million; California, third with 38 million; Ohio, fourth with 33 million; and Illinois ranked fifth with 32 million gallons produced.

ADVANTAGES AND DISADVANTAGES OF DAIRYING

The fact that dairy cattle are maintained on approximately 50 per cent of our farms indicates that the enterprise has certain advantages. The fact that the enterprise is not popular on about the same number of farms, and that the number of farms on which

dairy cattle are kept is decreasing, indicates certain disadvantages.

Advantages of Dairying. 1. *Dairying fits in well in diversified farming programs.* Diversification is highly recommended on many farms to permit efficient use of farm labor and economical use of buildings and equipment and to reduce the risk involved in having but one or two sources of income.

2. *Cows are efficient consumers of roughages.* Cows make effective use of large quantities of roughages which on some farms may be wasted.

3. *Dairying provides a stable income.* Beef and sheep prices are less stable than the prices of dairy products.

4. *Income is distributed throughout the year.* Most of such farm income as beef and lamb and corn, wheat, and other crops is seasonal. Dairy production and income may be distributed throughout the year.

5. *Dairy production improves the family diet and reduces food costs.* Milk is a basic food and an important item in the family food budget. A small dairy enterprise can be justified on many farms just for the production of milk products for family consumption. This is especially true where large families are involved. Farmers in the South Central states in 1950 used more milk for home consumption than was marketed.

FIGURE 147. *A high-producing herd of Holstein cattle. (Courtesy Holstein-Friesian Association of America.)*

6. *Skim milk is of high value as poultry and swine feed.* Farmers who sell butterfat make effective use of skim milk in feeding pigs and poultry. Skim milk is an excellent source of protein, minerals, and vitamins. The dairy enterprise indirectly affects the production of poultry, eggs, and pork on farms where only the butterfat is sold.

7. *Dairying aids in maintaining soil fertility.* Dairy farming fits in well with grassland farming. Legumes and grasses are grown for hay and pasture. These crops are soil conserving or building crops. The manure produced is distributed on the land, and returns plant food nutrients to the soil. These nutrients would be lost if the land was used in producing cash grain crops.

The feeding of grains to dairy cows permits the return to the soil of 50 to 80 per cent of the plant food elements in the grain.

Disadvantages of Dairying. 1. *Dairying has a high labor requirement.* Dairying is a full-time job. Cows must be fed and milked at least twice each day, and time is consumed in managing the enterprise and in marketing the products, whereas other types of livestock require less labor. It is sometimes difficult to obtain desirable labor to care for dairy cattle.

2. *Considerable capital is required.* The production of high quality dairy products requires that certain sanitary housing and equipment standards be met. These standards have increased the investment in the dairy enterprise. According to U.S.D.A. data, the average dairy cow in the nation by January, 1953 was valued at $202. The cows in New York were valued at $258, those in Wisconsin at $240, and those in California at $250. A herd of twenty good cows involves an investment of from $4400 to $6000.

The investment in feed for a herd of twenty cows is quite large. The average cost of feeding a cow in 1951, according to national dairy herd improvement association records, was about $165. A herd of twenty cows will require an investment in feed amounting to $3300.

3. *There are many hazards in dairy production.* Dairy cows may become infected with abortion, tuberculosis, and other diseases. Disease losses are serious when valuable animals are involved. Mastitis losses are heavy in some herds.

Breeding, nutritional, housing, and market problems also may cause losses, but these losses are usually no more serious with dairy cattle than with other types of livestock.

4. *Substitutes for dairy products are materially affecting the dairy enterprise.* The change in status of butter due to butter substitutes has affected the profitableness of the dairy enterprise. The quality of butter needs to be improved, and better marketing practices are needed. The cost of producing butter must be reduced if it is to compete with butter substitutes.

FACTORS IN PROFITABLE PRODUCTION

Dairying usually can be expected to produce a rather high return on investment in feed when labor costs are ignored. Where family labor can be used, dairying is quite profitable. It may be another matter if hired labor must be used. Labor and feed costs are the major factors in dairy production. Building and equipment costs are secondary in most cases.

Data shown in Table 28 indicate the importance of labor in dairy production as compared with other livestock enterprises.

TABLE 28

RETURNS PER $100 OF COSTS FROM DIFFERENT KINDS OF LIVESTOCK AND FEEDING SYSTEMS, 1917 TO 1948 *
(Derived for Iowa)

Enterprises and Feeding Systems	*Returns per $100 of Feed Fed*	*Returns per $100 of Feed and Labor Costs*	*Returns per $100 of All Costs*
Dairy cows averaging 323 lbs. butterfat..	203	127	109
Yearling steers, choice †	128	118	104
Feeder calves, good to choice ‡	134	120	106
2-year-old steers, choice §	136	129	103
Hogs, Iowa average	157	139	114

* Jensen and Heady, *Iowa Farm Science*, May, 1953.
† Placed in dry lot at 610 pounds in November; fed and sold as choice in October at 1060 pounds.
‡ Bought in October at 440 pounds; wintered and fed out in dry lot for sale in August as choice at weight of 1000 pounds.
§ Bought at 800 pounds in August; pastured one month, put in dry lot, and finished to choice at 1150 pounds in January.

Effect of Quantity of Production upon Cost. According to DHIA records, the best way to increase the profit from the dairy herd is to increase production. Records show that the income over feed costs increases as the level of milk production is increased. It costs about $13 more per year to feed a cow which produced 9000 pounds of milk than it costs to feed a cow which produced 7000 pounds. The income over feed cost was $204 for the cow which produced 7000 pounds and $254 for the 9000 pound cow. A herd of twenty cows producing an average of 9000 pounds of milk

will net the owner $1040 more per year than will the same number of cows which produce an average of only 7000 pounds, even though the feed bill was higher for the former.

TABLE 29

HIGH PRODUCING COWS PRODUCE MILK AT LOW FEED COST PER 100 POUNDS
(United States DHIA Records, 1951)

Level of Milk Production (lbs.)	*Value of Product* ($)	*Feed Cost* ($)	*Income over Feed Cost* ($)	*Feed Cost per 100 lbs. of Milk* ($)
5,000	269	135	134	2.70
7,000	356	152	204	2.17
9,000	421	165	256	1.83
11,000	473	176	297	1.60
13,000	533	189	344	1.45
15,000	600	200	400	1.33

METHODS OF INCREASING DAIRY PROFITS

The average production of the cows in the dairy herd improvement associations of this nation in 1952 produced almost twice as much milk and butterfat as did the average cow in the nation. Production can be increased on most farms by carefully analyzing the methods and making the changes necessary to bring the herd up to the most profitable level of production.

The following are the essentials in developing a profitable dairy enterprise:

1. Select carefully production and breeding stock.
2. Follow a constructive breeding program.
3. Provide adequate but economical housing.
4. Feed cows a balanced ration according to their maintenance and production needs.
5. Make efficient and economical use of high quality hay, pasture and silage crops.
6. Provide an adequate water supply.
7. Use good management practices in growing out herd replacement stock.
8. Follow production practices conducive to the production of high quality milk.
9. Safeguard the herd from diseases and parasites.
10. Keep production records of individual cows, and cull animals as the need arises.

11. Carefully select the best method of marketing and market outlet.
12. Adjust the scope of the dairy enterprise to the capital, feed and labor available, and to the market outlook.

SUMMARY

Dairy cattle provided 13.2 per cent of our nation's cash farm income in 1951. The number of dairy cows in this nation by January, 1953 was 23.9 million, a reduction of 2.1 million from the number in 1944. Wisconsin, Minnesota, and New York lead the states in number of milk cows.

The average production per cow in 1952 was 5290 pounds of milk and 211 pounds of butterfat. The average production of cows in dairy herd improvement associations in 1951 was 9195 pounds of milk and 370 pounds of butterfat.

Minnesota, Iowa, and Wisconsin produced nearly 50 per cent of the nation's butter in 1950. Only about 25 per cent of the nation's milk production is used in making butter. Ten per cent of our total milk production is used to make cheese. Wisconsin was responsible in 1950 for nearly 50 per cent of the nation's cheese production. About 6.6 per cent of the milk produced in this country is used in the manufacture of ice cream. Pennsylvania, New York, and California are the largest ict cream producing states.

Each person in the United States consumed, in 1951, 9.7 pounds of butter, 7.2 pounds of cheese, and 14 quarts of ice cream. Butter consumption is declining and margarine consumption is increasing. More than 50 per cent of our total milk supply is consumed as fluid milk or as cream.

Dairying fits well in diversified farming programs. Cows are efficient producers of human food nutrients and are able to convert roughages into milk. The income from dairying is quite stable from year to year, and is well distributed throughout the year. Dairy production is less risky than beef production, encourages soil conservation, and aids in reducing the family living costs.

The income per hour of labor is not great in dairy production because of the high labor requirement. Labor and feed are the two major factors in milk production. The big problem of dairymen is the competition of butter substitutes.

Dairy income may be increased by careful selection of produc-

tion and breeding animals, by feeding better rations, by making efficient use of hay and pasture crops, by controlling diseases, by improving the quality of product marketed, and by adjusting the scope of the enterprise to the market outlook and to the capital, housing, feed, and labor available.

QUESTIONS

1. How does the income from the dairy enterprise in your community compare with the income from the other livestock enterprises?
2. What changes have come about in the consumption of dairy products in this country during the past twenty-five years?
3. Which states lead in milk production, and how do you account for their large production?
4. What changes have come about in average production of milk and butterfat per cow during the past twenty years?
5. Which provides the best market for milk in your community: fluid milk distributors, the cheese factory, the creamery, or the condensed milk plant? Explain.
6. Explain the chief advantages and disadvantages of dairy production.
7. How much milk and butterfat do the cows on your farm need to produce to net a profit?
8. What factors do you need to consider in improving dairy production on your farm?

REFERENCES

Jensen, Harold R., and Heady, Earl O., "Dairying's Place in the Farm Business," *Iowa Farm Science*, Iowa State College, May, 1953.

Milk Industry Foundation, *Milk Facts, 1952–1953 Edition*, Washington, D. C.

Petersen, W. E., *Dairy Science*, J. B. Lippincott Company, Philadelphia, 1950.

U. S. Department of Agriculture, *The Dairy Situation*, Bureau of Agricultural Economics, Washington, D. C., July–August, 1952.

U. S. Department of Agriculture, *Dairy Herd Improvement Association Letter*, Vol. 28, No. 6; Vol. 29, No. 3, Bureau of Dairy Industry, Washington, D. C.

U. S. Department of Agriculture, *Livestock and Poultry on Farms and Ranches on January 1*, Bureau of Agricultural Economics, Washington, D. C., February, 1952.

< 17 >

Selection of Breeding Stock

Good seed stock is essential for profitable production in both crops and livestock. Fertilizer applications made to high yielding hybrid strains of corn net more profit than when applied to low yielding strains. Heavy feeding of concentrates to choice feeder cattle may be very profitable, while the same feeding program applied to common steers usually is unprofitable. The same principle may be applied to dairy production.

Dairy cows are maintained for their production of milk and offspring, and they vary in their capacity to produce. The eighty high producing herds in the Dairy Herd Improvement Association in Iowa in 1951–1952 produced an average of 10,620 pounds of milk and 430 pounds of butterfat. The low eighty herds produced an average of 6772 pounds of milk and 278 pounds of butterfat. The differences in production were due to several factors, but most important were the type and inherent productiveness of the cows and the feeding programs which were followed.

It is not unusual to discover cows in individual herds which produce 1½ to 2 times as much milk and butterfat as other cows in the same herd which were fed the same rations. In one state nearly 10 per cent of all cows in DHIA herds were sold in 1951–1952 because of low production. It pays to use good judgment in selecting the cows to be used in starting a dairy enterprise, and it pays to cull out the unprofitable cows in established herds.

FACTORS IN SELECTING DAIRY ANIMALS

Four factors or criteria may be involved in selecting dairy animals: (1) breed, (2) pedigree, (3) production records, and (4) physical appearance.

Most dairymen who maintain breeding herds maintain but one herd. With the use of artificial insemination, however, it is possible to keep cows of more than one breed and provide satisfactory

bull service. Pedigree information is available for purebred dairy animals but is not always available for grades.

Production records are available for animals in DHIA herds and in many other herds which have been tested by vocational agriculture students, 4-H club members, or by the individual breeders. Less than 5 per cent of the milk cows of the nation by January, 1953 were on test in dairy herd improvement associations.

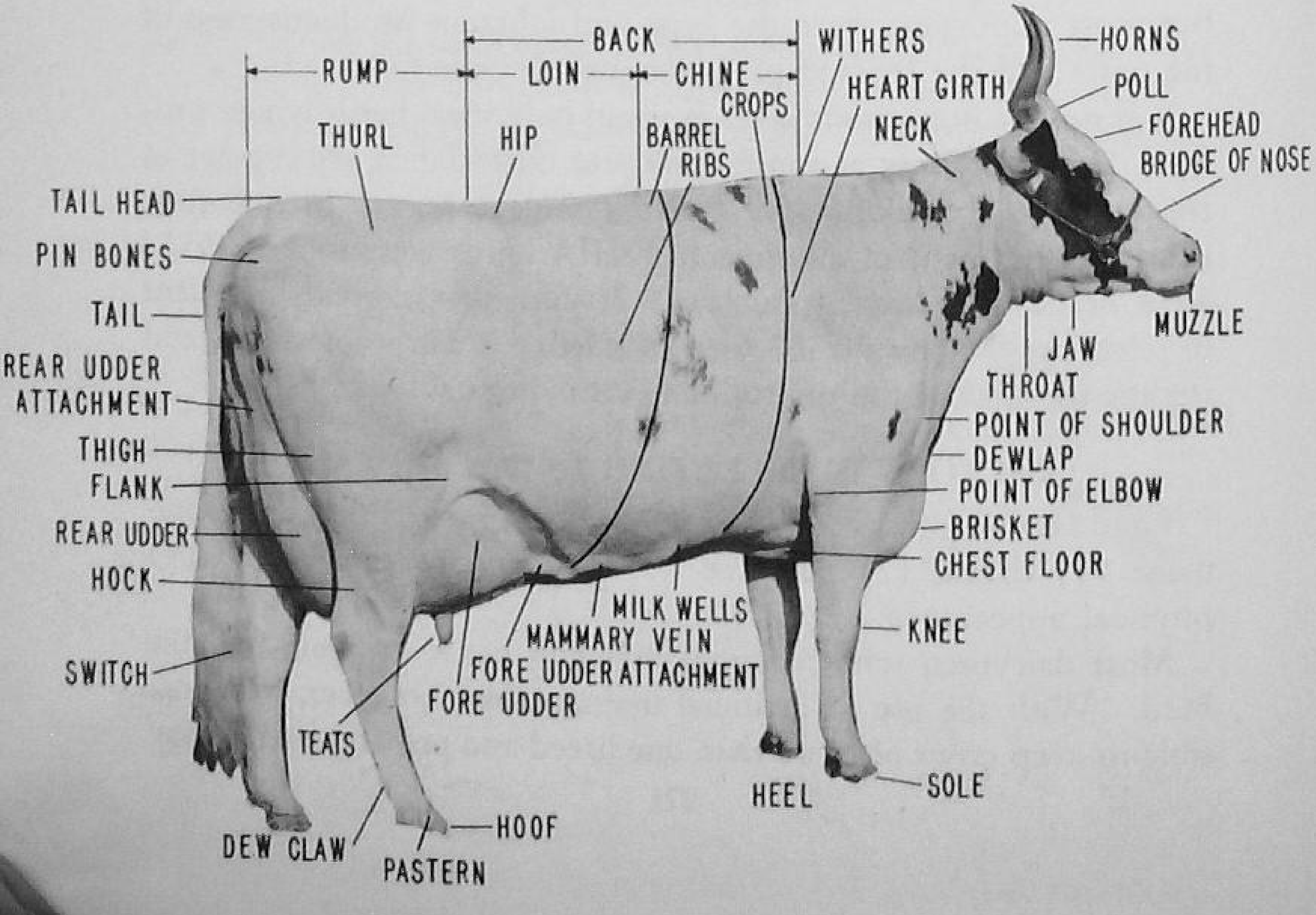
Quite often the selection of dairy animals is based largely upon the general physical appearance and type of the individual. When pedigree and production record information is not available, selection must be based upon the characteristics of the individual animals.

The ideal method in selecting dairy animals is to have available and consider carefully all four criteria—breed, pedigree, production record, and physical appearance.

PARTS OF A COW

It is important that we know the parts of a cow and understand the terminology to be able to follow the discussion related to the selection of dairy animals. Shown in Figure 148 is a picture of a dairy cow with the various parts indicated.

FIGURE 148. *Parts of a dairy cow. (Strohmeyer & Carpenter photo. Courtesy Ayrshire Breeders' Association.)*



BREEDS OF DAIRY CATTLE

There is no one best breed of dairy cattle, but there may be a best breed for an individual farmer. The type and quality of breeding stock available in the community, the climatic conditions, the availability of markets for milk and butterfat, the types of pasture and forage crops available, and the personal preference of the individual dairyman are the determining factors in selecting a breed.

Some breeds are more rugged than others and as a result are better grazers and can stand colder climates. Some breeds consume larger amounts of roughages and concentrates. The breeds differ somewhat in the butterfat content of the milk.

There are good individuals in every breed, and the differences between breeds are of less importance than the differences within the individual breeds. The breed best suited to a production program should be carefully selected, and major emphasis should be placed upon the breeding or selecting of individuals which will be most productive under your management.

The five common breeds of dairy cattle are the Holstein-Friesian, the Guernsey, the Jersey, the Ayrshire, and the Brown Swiss. Two other dairy breeds are grown in smaller numbers—the Red Danish and the Dutch Belted.

Holstein-Friesian. *Origin.* Holstein cattle had their origin in

FIGURE 149. *The ideal type Holstein bull. (Courtesy Holstein-Friesian Association of America.)*

Holland, and were imported to this country beginning about 1625. In Holland they were called Friesians and were bred to produce large quantities of milk for use in making cheese.

Most of the importations of Holsteins were made between 1875 and 1905. No importations have been made since 1905, but a total of more than 7700 animals have been brought to this country.

Color. To be eligible for registration, a Holstein must be black and white, and the amounts of black and white may vary from white with a few black spots to almost black. The switch must always be white. Animals are not recorded which are all white, all black, or which have black on their legs below the knees or hocks.

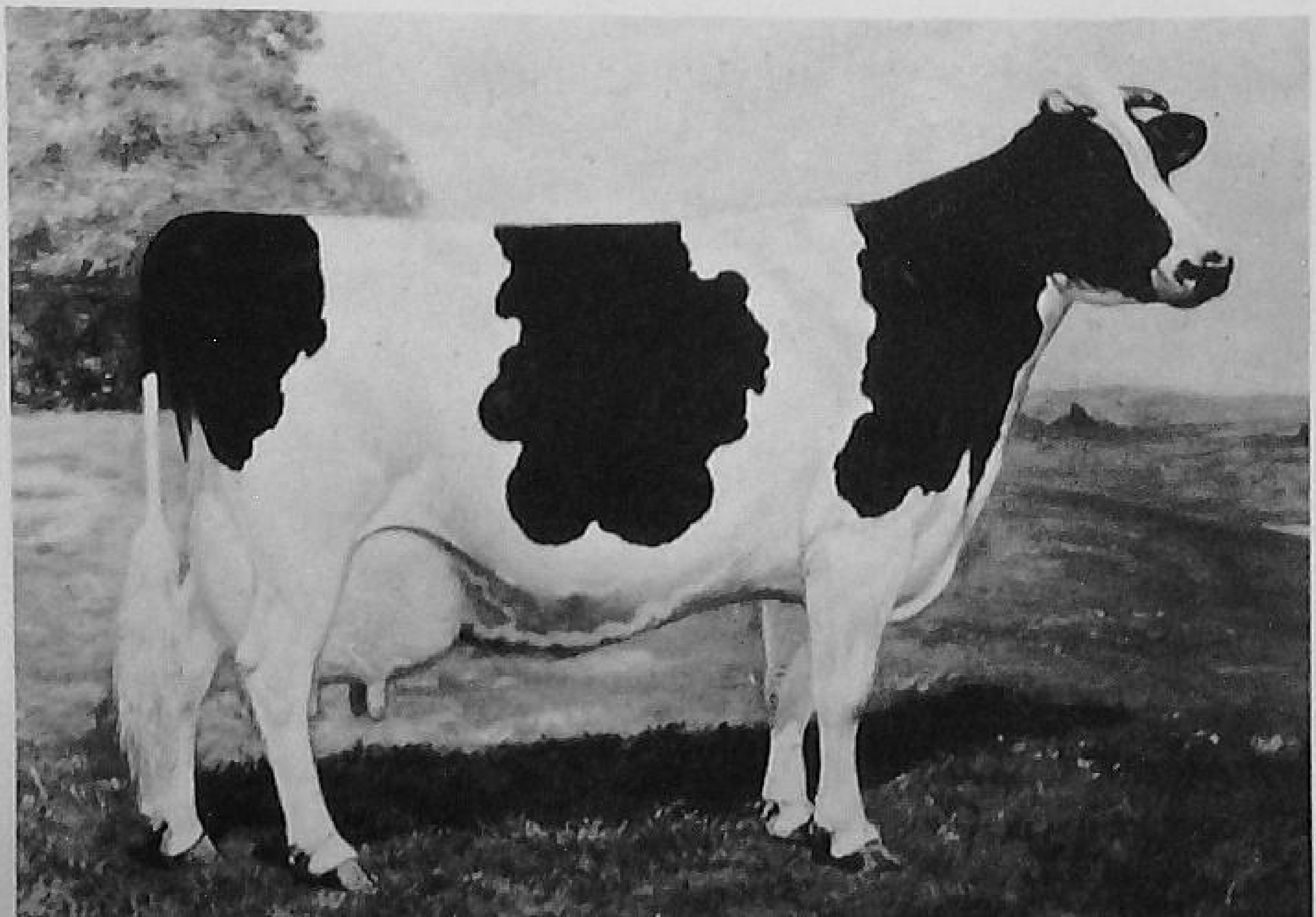
Size. The standard weight for Holstein cows is 1250 pounds, and the bulls should weigh at least 1800 pounds. Many cows weigh 1300 to 1600 pounds, and some bulls weigh over a ton. Holsteins are larger than most of the animals of the other breeds.

Conformation. Animals of this breed are ruggedly built, and possess large feeding capacities and udders. The head is long, narrow, and straight. Straight thighs and slightly rounded withers are desired.

Disposition. The cows are quiet and docile, but the bulls may be vicious.

Grazing ability. Holstein cows are excellent grazers, especially on good pastures. They have large middles and can consume large

FIGURE 150. *The ideal type Holstein cow. (Courtesy Holstein-Friesian Association of America.)*



amounts of forage. They are not so good as some of the smaller breeds on poor pastures.

Production. Holstein milk is lower in fat than is milk from any of the other dairy breeds. It averages about 3.5 per cent butterfat but varies from about 2.5 to 4.3. Holsteins produce large quantities of milk and rate high in total butterfat production.

To July, 1948, a total of 4129 Holstein cows had produced 800 pounds or more of butterfat in 365 days; 416 cows had produced more than 1000 pounds; and 21 had exceeded 1200 pounds of butterfat in a year.

A ten-year-old Holstein cow, Carnation Homestead Daisy Madcap, now holds the world's record in butterfat production. She completed in January, 1953 an official test record of 1511.8 pounds of butterfat and 36,414.1 pounds of milk in 365 days. This cow weighed 1900 pounds and had previously produced 1173.1 pounds of butterfat and 30,942 pounds of milk as a six-year-old; and 1413.6 pounds of butterfat and 34,553 pounds of milk as a seven-and-a-half-year-old.

FIGURE 151. *Carnation Homestead Daisy Madcap, world's champion producer of butterfat with a record of 1511.8 pounds of butterfat and 36,414.1 pounds of milk. (McQuade photo. Courtesy Carnation Milk Farms.)*

Holstein cows on official test are classified according to their production as Advanced Registry cows. Cows two years old must produce 318 pounds of fat in 365 days; three-year-olds, 372 pounds; four-year-olds, 426 pounds; and five-year-olds must produce 480 pounds of butterfat in 365 days.

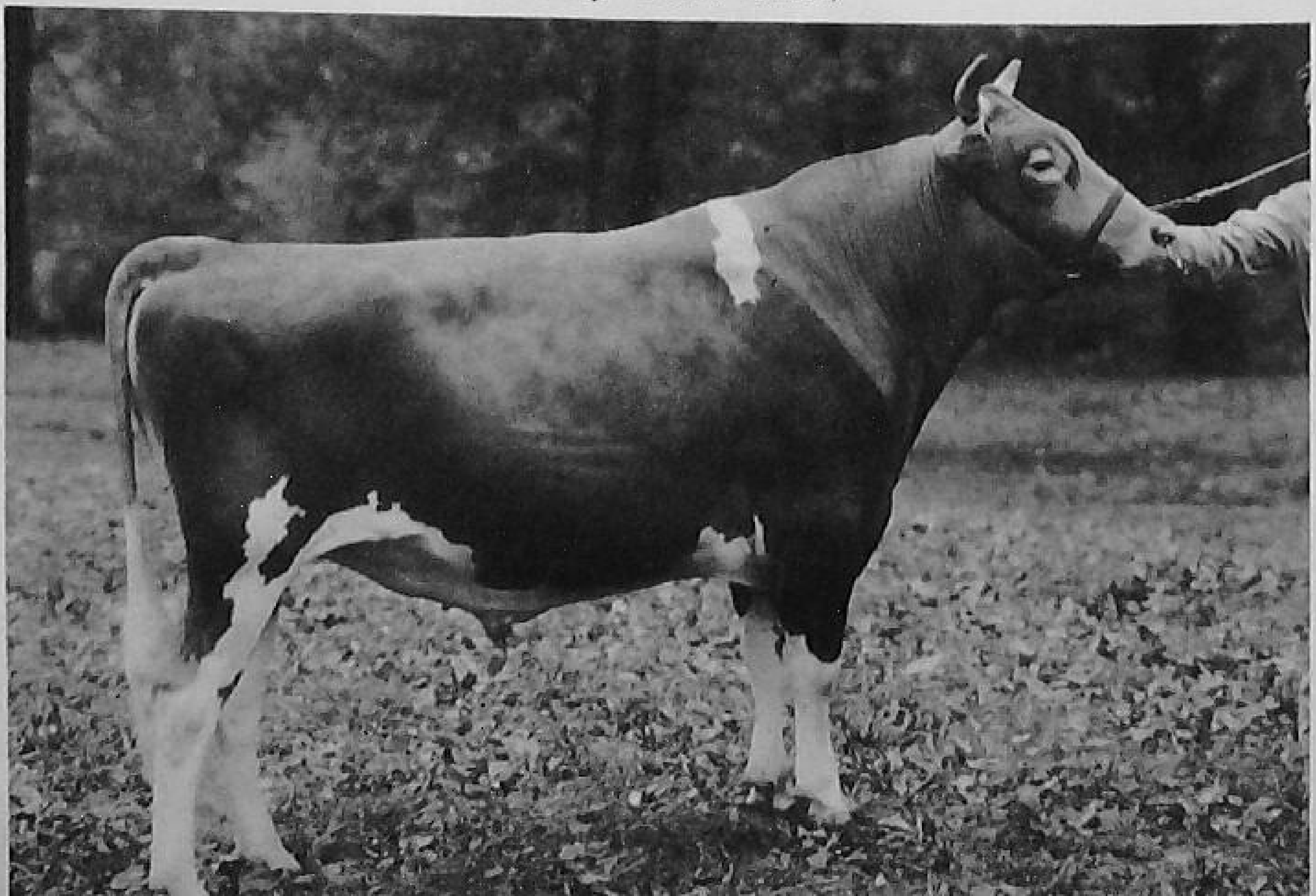
Holstein calves are large and vigorous, weighing an average of about 90 pounds. Steers of this breed feed out well and produce lighter colored fat than steers of the other dairy breeds.

Availability of breeding stock. More Holsteins were recorded in 1952 than cows of any other dairy breed. A total of 189,690 animals were recorded with the Holstein-Friesian Association of America, Brattleboro, Vermont. Of the 909 dairy sires used by the artificial insemination associations in this country in 1952, 384 were Holsteins. According to DHIA records more Holsteins were reported in some states than cows of all other dairy breeds combined.

Guernsey. *Origin.* This breed has been imported from the small Island of Guernsey, which is located off the coast of France. Approximately 113,000 head of Guernseys have been imported.

Color. The color of the Guernsey varies from a light fawn to almost red, with white markings on the face, legs, switch, and flank. Some white may appear on the body. The nose should be cream or buff colored, however smoky color is permitted. The skin is yellow.

FIGURE 152. *McDonald Farms Steadfast Odin, Grand Champion Bull, 1951 National Guernsey Show. (Strohmeyer & Carpenter photo. Courtesy American Guernsey Cattle Club.)*



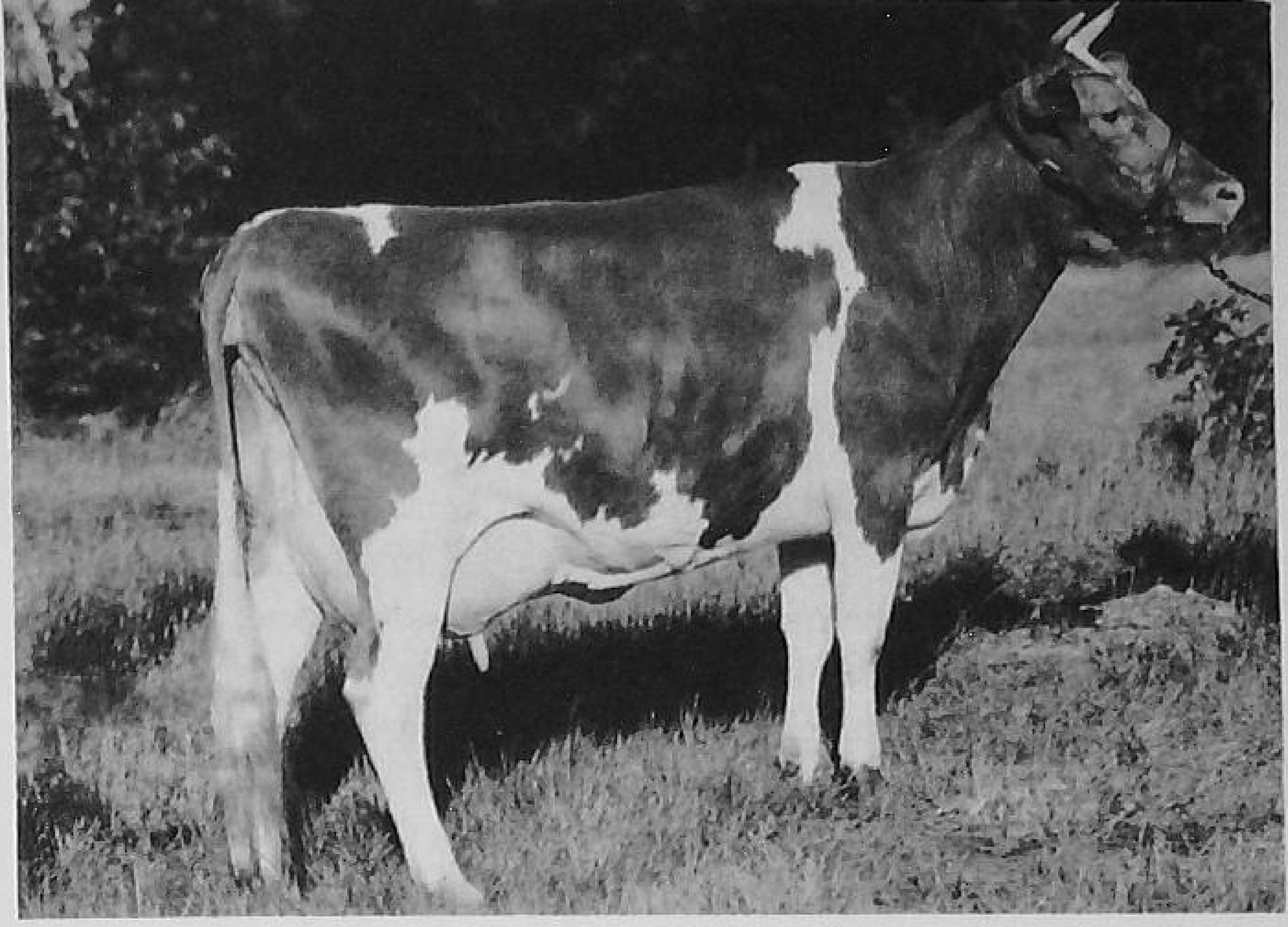


FIGURE 153. *Hagan Farms Merry Song, Senior and Grand Champion Guernsey Female and Best Uddered Cow, 1952 National Guernsey Show. (Strohmeyer & Carpenter photo. Courtesy American Guernsey Cattle Club.)*

Size. Guernsey cows average about 1100 pounds in weight but vary from 800 to 1300 pounds. The bulls average about 1700 pounds.

Conformation. The Guernsey is less rugged than the Holstein but more rugged than the Jersey. The cows may be inclined to be rough over the rump and weak in the loin. The udders are less symmetrical than those of the Jersey. The face of the Guernsey is double dished but longer than that of the Jersey.

Disposition. Cows of this breed are alert and active but are not nervous. They are easily managed.

Grazing ability. The Guernsey is a good grazer but not equal to the Holstein on good pasture or to the Jersey on poor pasture.

Production. Guernsey milk has a golden color and is popular on the consumer market. It contains nearly 5 per cent fat. "Golden Guernsey" milk quite often sells at a premium. Guernseys usually produce less milk than the Holstein, but it is higher in fat content.

To June, 1948, a total of 29,302 cows on official test carried calves 200 days or more and produced an average of 10,716 pounds of milk and 532 pounds of butterfat. The average test was 4.9. An additional 57,860 records were made, averaging 10,560 pounds of milk and 522 pounds of butterfat by cows which did not carry calves 200 of the 365 days of the year.

The top milk producer of the Guernsey breed, with a record of 26,672 pounds of milk and 1120 pounds of butterfat, is Welcome In Forward's Clara.

Availability of breeding stock. Guernseys are grown in all areas of the nation and in 1952 ranked second to the Holstein breed in number of purebred animal recordings. A total of 113,909 animals were recorded by the American Guernsey Cattle Club of Peterborough, N. H. Of the 909 sires used by artificial insemination associations in the nation in 1952, 214 were Guernseys.

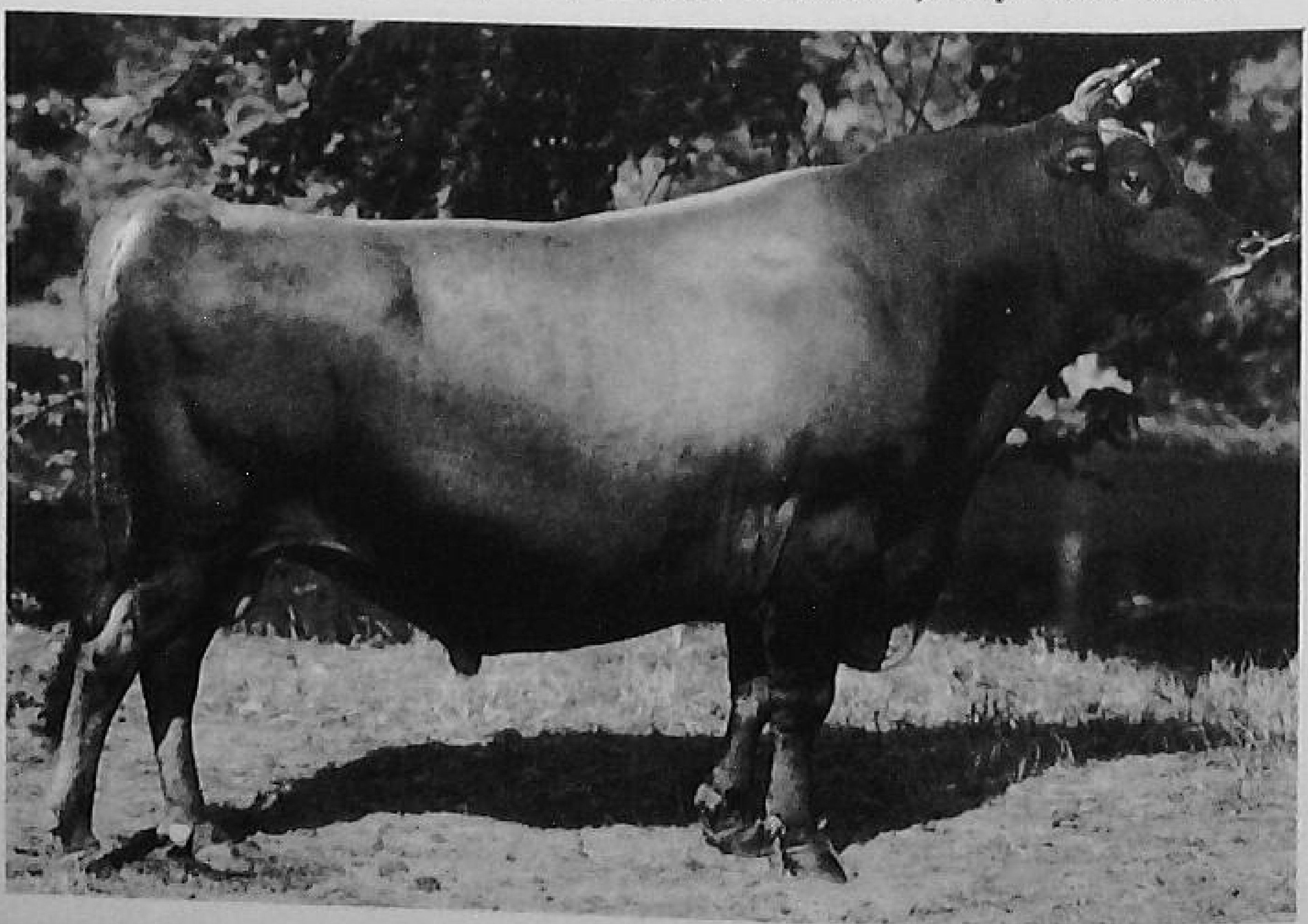
Jersey. *Origin.* This breed was developed on the Island of Jersey in the English Channel. Importations of Jerseys to this country began around 1850. About 36,000 animals have been imported, of which 3,800 head were brought in since 1935.

Color. Jerseys vary in color from light fawn to black and from white spotted to solid in marking. The tongue and switch may be black or white. The muzzle is black with a light colored encircling ring.

Size. The Jersey is the smallest of the dairy breeds. The cows range in weight from 800 to 1100 pounds and the bulls from 1200 to 1600 pounds. The imported animals are usually smaller than the Jerseys produced in this country.

Conformation. The Jersey approaches the true dairy type. The cows have straight top lines, level rumps, and sharp withers. Their heads have a double dish, and they show dairy temperament in

FIGURE 154. *Pompous Dreaming Standard, an excellent, superior Jersey Sire with eighteen daughters averaging 10,652 pounds of milk and 562 pounds of butterfat. (Strohmeyer & Carpenter photo. Courtesy American Jersey Cattle Club.)*



eyes and neck. Jerseys have excellent udders, both in shape and in fore and rear attachment.

Disposition. Jerseys are inclined to be nervous and sensitive. They can be pets under good management or mean under poor management. The bulls of this breed are often quite vicious.

Grazing ability. No dairy animal excels the Jersey in grazing ability on medium to poor pastures. They are small and active, so their maintenance requirements are lower than for cows of the larger breeds.

Production. Jersey calves are small at birth and more difficult to raise than calves of some of the larger breeds. Calves usually weigh from 50 to 60 pounds. Jerseys mature, however, in twenty-four to twenty-six months.

Jersey milk averages about 5.3 per cent fat and contains almost 15 per cent solids. It sells at a premium because of its superior quality. It is yellow in color and is often sold as "Jersey Cream Line" milk.

Jerseys do not produce large quantities of milk, but they produce it economically on little feed.

The Register of Merit and Herd Test records are kept of the production of Jersey cows by the American Jersey Cattle Club of Columbus, Ohio. To March 1948, 76,862 production records had been accepted by the American Jersey Cattle Club. The 365

FIGURE 155. *Imp. Wonderful Snowdrop, an Excellent, Grand Champion, Ton of Gold cow. On a twice-daily milking, 305-day mature cow equivalent basis, this cow produced 10,576 pounds of milk containing 619 pounds of butterfat. (Strohmeyer & Carpenter photo. Courtesy American Jersey Cattle Club.)*

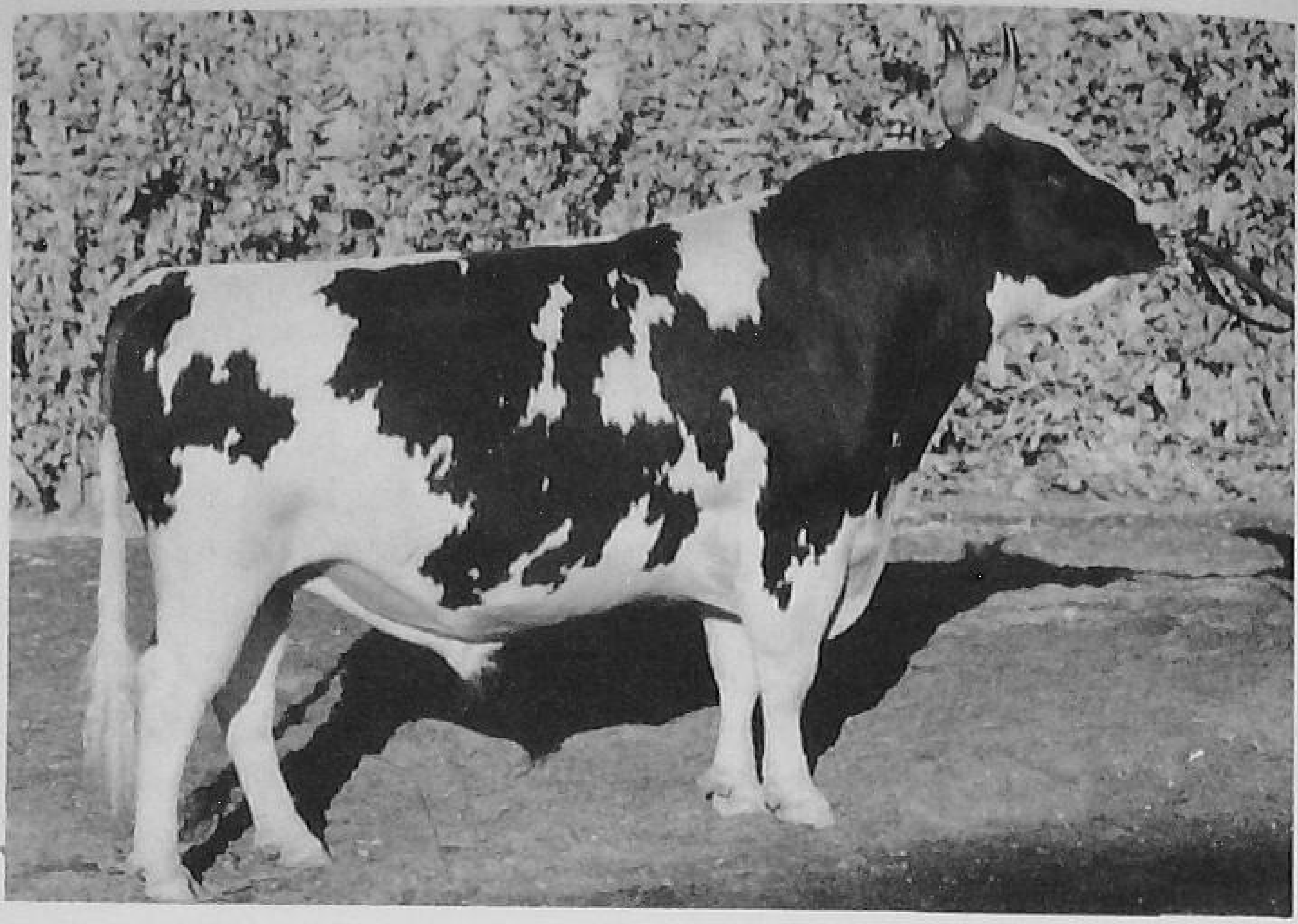


FIGURE 156. *Netherhall Swanky Dan, Imported, a world's record Ayrshire show-ring winner, claiming eighty-four Grand Championships. (Strohmeyer & Carpenter photo. Courtesy Ayrshire Breeders' Association.)*

day records averaged 9037 pounds of milk and 485.3 pounds of butterfat. The average butterfat test was 5.37 per cent.

Some of the champion producers are Stockwell's April Pogis of H. P. 694,544, which produced 17,880 pounds of milk and 1218 pounds of butterfat in 365 days; and Missionary Noble Alice 1,199,012, which produced 19,390 pounds of milk and 1038 pounds of butterfat in 305 days.

Availability of breeding stock. Jerseys are more numerous in the South, East, and Pacific Coast areas. In 1952, 70,343 animals were recorded. The breed ranks third in number of animals recorded, in the number of bulls used in artificial insemination associations, and in the number of cows in DHIA herds.

Ayrshire. *Origin.* This breed was developed in Scotland and was first imported to this country in 1822. Since 1920 Ayrshire importations have been largely from Canada.

Color. Ayrshires are red with white markings or white with red markings. The red may be very light or almost black.

Size. The size of the Ayrshire is in between that of the Guernsey and the Holstein. Cows average about 1250 pounds, and the bulls weigh from 1600 to 2300 pounds.

Conformation. The Ayrshire is considered by many as the most beautiful dairy breed. The animals have straight top lines, level rumps, and good udders. Ayrshires have long horns which are

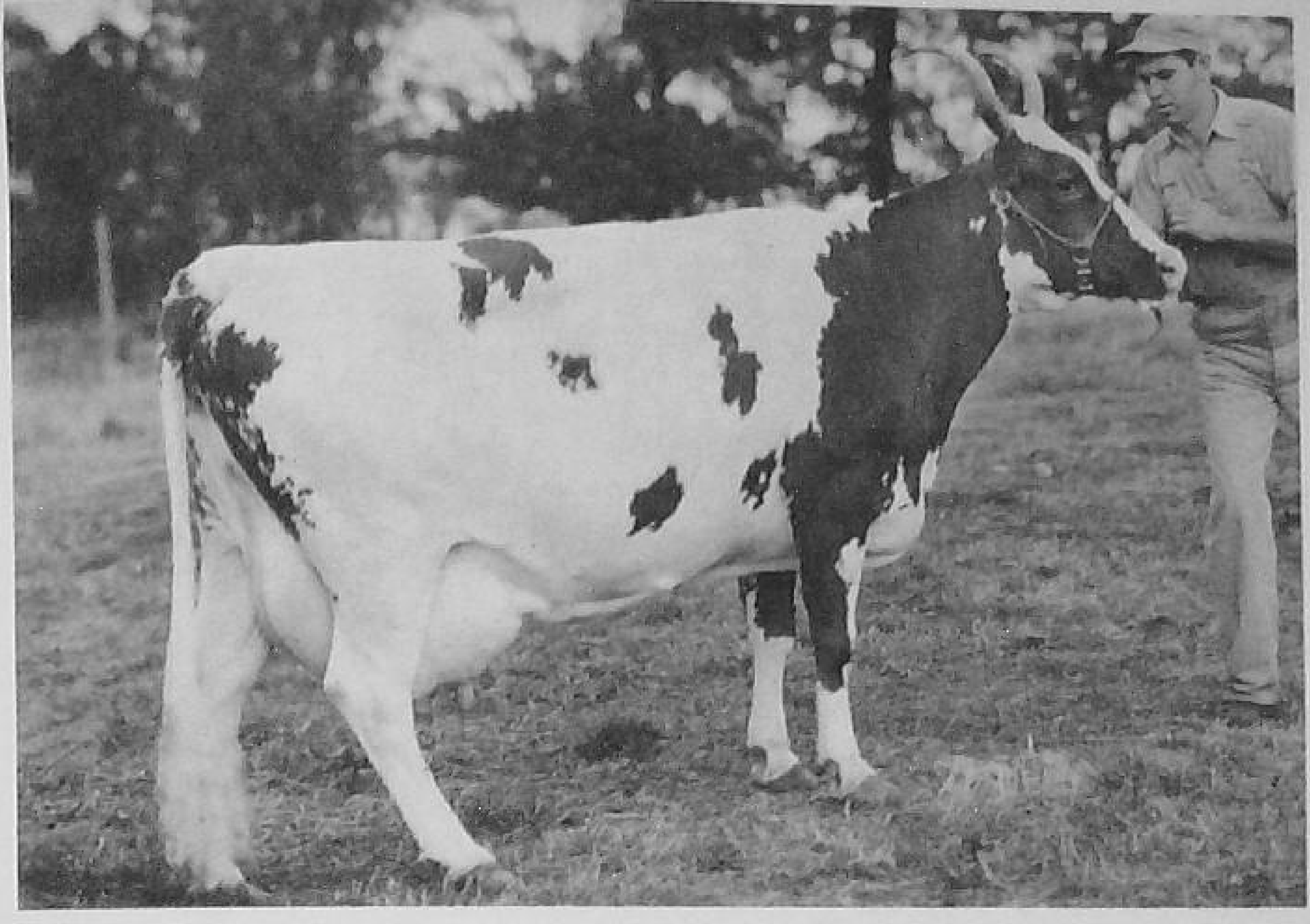


FIGURE 157. *Neshaminy Miss Phett holds the Ayrshire and all breed 305-day butterfat record on twice-a-day milking. She produced 20,946 pounds of milk and 1036 pounds of butterfat. (Strohmeyer & Carpenter photo. Courtesy Ayrshire Breeders' Association.)*

trained upward. Ayrshires may be shorter and thicker in the neck than some of the other dairy breeds.

Disposition. Ayrshires are very active and may be nervous and hard to manage. They are good rustlers.

Grazing ability. Ayrshires are excellent grazers because of their ruggedness, stamina, and activity.

Production. Ayrshires do not produce as much milk or butterfat as some of the other breeds. The milk usually averages 4.0 per cent butterfat and about 12.75 per cent total solids.

The Ayrshire Herd Test plan is followed in production testing. All cows in the herd must be tested, and they are milked twice daily for 305 days. Neshaminy Miss Phett 269618 completed in 1951 an all-breed record of 20,946 pounds of 4.9 per cent milk and 1036 pounds of actual fat in 305 days.

The average production of cows tested on the Ayrshire Herd Test plan up to 1948 was 9016 pounds of milk and 367.8 pounds of butterfat. The average butterfat test was 4.08 per cent.

Ayrshire calves weigh 70 to 80 pounds and make good vealers. The meat from Ayrshire cattle has better color than that from Jerseys or Guernseys. Ayrshires mature in twenty-six to twenty-eight months.

Availability of breeding stock. Ayrshires are more prevalent in

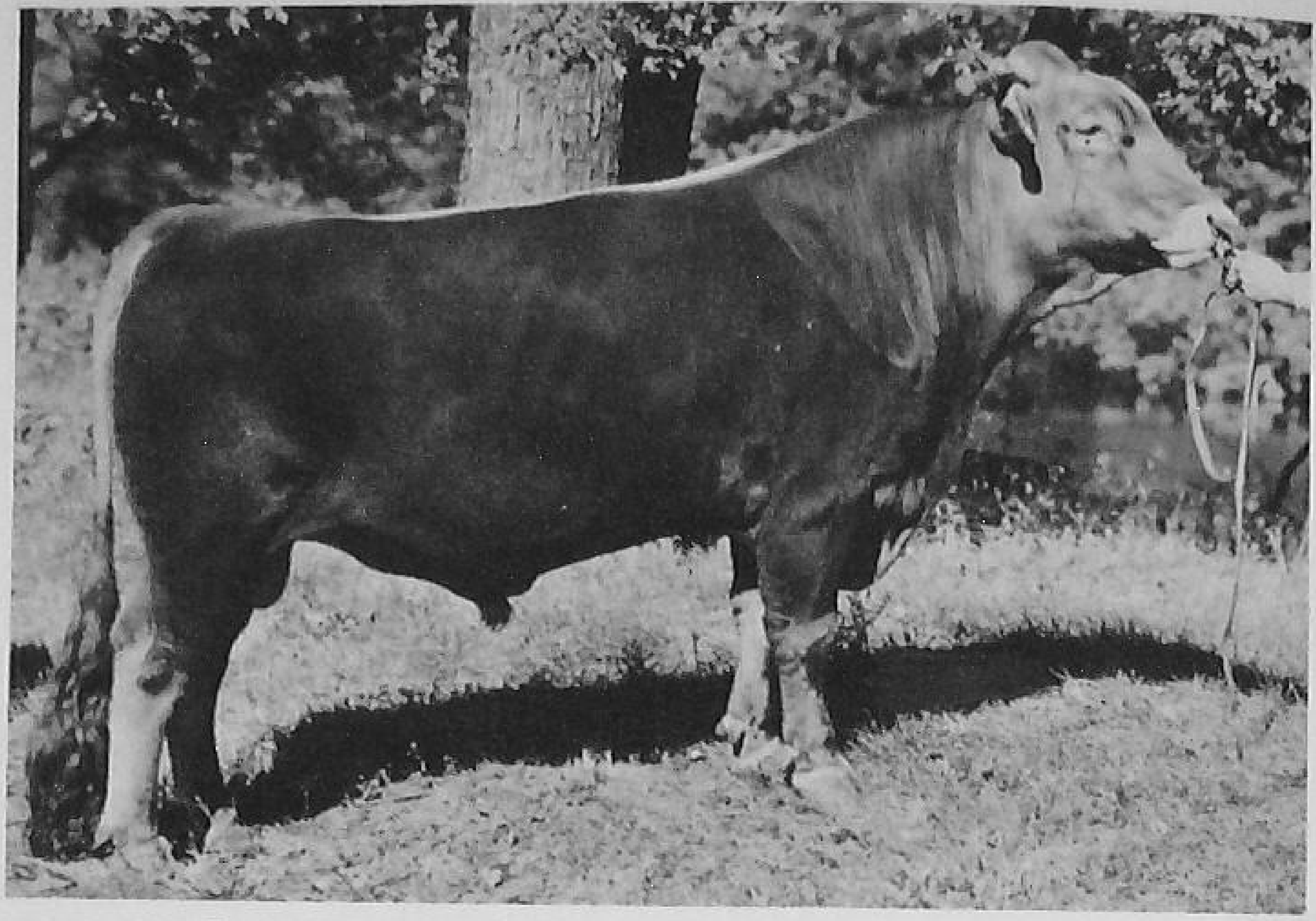


FIGURE 158. *Lee's Hill Keeper's Asset, Grand Champion Brown Swiss Bull 1951 National Dairy Cattle Congress. (Strohmeyer & Carpenter photo. Courtesy Brown Swiss Cattle Breeders' Association.)*

the New England states, Pennsylvania, and New York. Only 23,208 animals were recorded by the Ayrshire Breeders Association of Brandon, Vermont, in 1952, and only forty-three of the 909 bulls used by the artificial insemination associations in 1952 were of this breed. Only 2.4 per cent of the cows tested in Dairy Herd Improvement Associations in Iowa in 1951–1952 were Ayrshires.

Brown Swiss. *Origin.* Brown Swiss cattle were developed in the mountainous areas of Switzerland and the first importation to this country took place in 1869. A total of 185 animals have been imported.

Color. The color varies from a light fawn to almost black. The muzzle and a stripe along the backbone is light in color. The nose, tongue, switch, and horn tips are black.

Size. The Brown Swiss breed is the largest, most rugged, and meatiest breed of dairy cattle. Mature cows weigh from 1200 to 1400 pounds, and bulls weigh from 1600 to 2400 pounds.

Conformation. This breed in Switzerland is used for power as well as for milk and beef, and as a result is not as refined as the other dairy breeds. The type and conformation of Brown Swiss cattle has been greatly improved during the last twenty years. Cows of this breed have large bones, large heads which are usually

dished, and thick, loose skin. Animals of this breed are not as angular as those of the other dairy breeds.

Disposition. Cattle of this breed are quiet, docile, and easily managed.

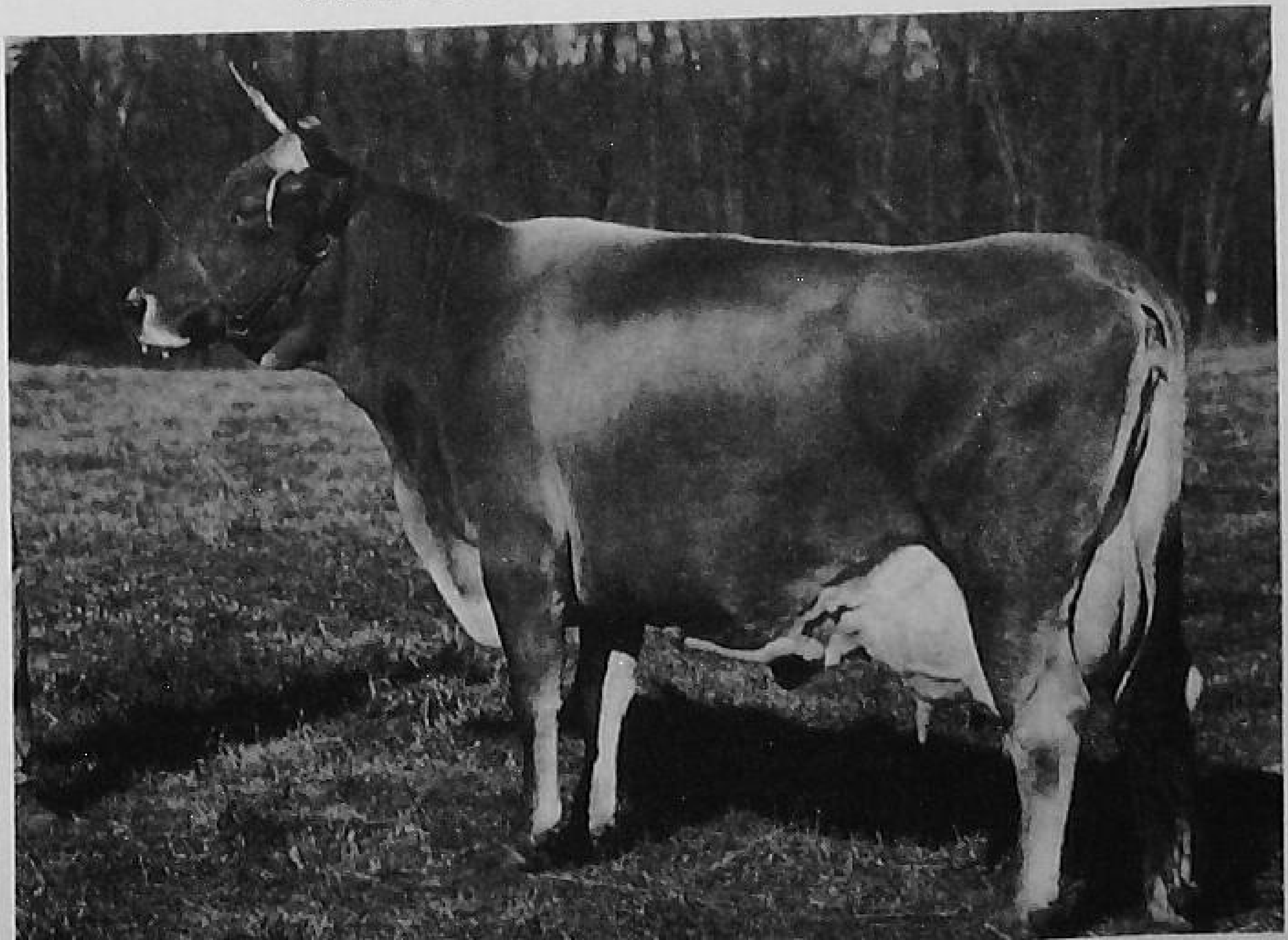
Grazing ability. Brown Swiss cattle are good grazers, because they are rugged and active.

Production. Calves of this breed will weigh from 90 to 100 pounds at birth. The fat is white, and they make good vealers. Steers and cows put on gains rapidly producing good beef.

Brown Swiss milk is white in color and contains about 4 per cent fat. Registry of Production and Herd Improvement Tests are supervised by the Brown Swiss Breeders Associations of Beloit, Wisconsin. To October, 1947, 11,171 cows had completed 305 day records, averaging 9446 pounds of milk and 365 pounds of butterfat on two-times-a-day milking. A total of 811 cows had completed 305 day tests on three milkings per day. They averaged 11,778 pounds of milk, and the average percentage of butterfat was 3.82. The cow with the highest production record of this breed is Royal's Rapture of Lee's Hill 115541, which produced as an eight-year-old a 365 day record, on three-times-a-day milking, of 31,283 pounds of milk and 1378.9 pounds of butterfat.

Availability of breeding stock. Brown Swiss cattle are most numerous in Wisconsin, Illinois, New York, and Michigan. Only

FIGURE 159. *Marinda Jane of Lee's Hill, Grand Champion Brown Swiss Cow 1951 National Dairy Cattle Congress. (Strohmeyer & Carpenter photo. Courtesy Brown Swiss Cattle Breeders' Association.)*



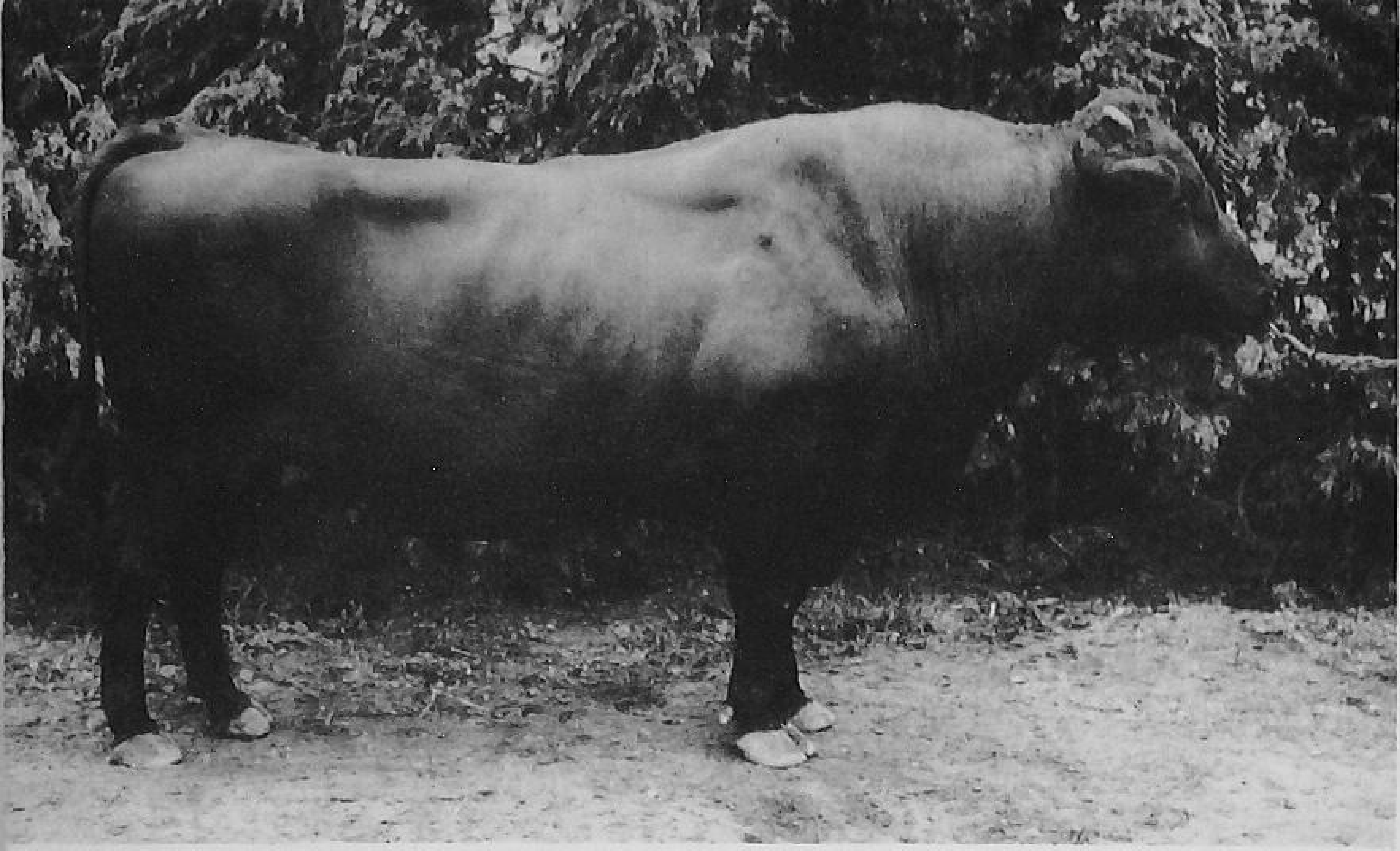


FIGURE 160. *Mature Red Danish bull in use by the Michigan Artificial Breeders at Michigan State College. (Courtesy Professor A. C. Baltzer, Michigan State College.)*

7.4 per cent of DHIA cows in Iowa in 1951–1952 were of this breed. Fifty-five of the 909 bulls used in artificial insemination associations in the nation in 1952 were Brown Swiss. The Brown Swiss Cattle Breeders Association registered 23,385 animals in 1952.

Red Danish. This breed was imported from Denmark by the U. S. Department of Agriculture, and animals were placed with some state colleges for experimental purposes. There were two males and twenty females in the original shipment.

The Michigan State College and a group of Michigan farmers have been proving sires for the U. S. Department of Agriculture, and as a result the American Red Danish Cattle Association has been formed with headquarters at Fairview, Michigan. The organization has some 225 members in eighteen states. Some 6000 cows are being bred to Red Danish bulls artificially in Michigan, and approximately thirty-five bulls are in use by members of bull clubs in that state.

The April issue of the American Red Danish Cattle Association News lists nine herds with 400 or more pounds of butterfat produced per cow in 1952. The butterfat test averages slightly over 4 per cent. Mature cows in average condition weigh from 1300 to 1500 pounds.

Dutch Belted. Dutch Belted cattle are native of Holland, and were imported in 1840 by P. T. Barnum of the Barnum and Bailey

Circus. A number of herds were developed in the New York and Pennsylvania area.

According to R. F. Litsey, of Nashville, Tennessee, secretary of the Dutch Belted Cattle Association of America, no animals are now on test. Herds are located in the New England states, Georgia, Florida, and Tennessee.

Mature cows weigh from 900 to 1500 pounds, and bulls average about 2000 pounds. The milk tests about 4 per cent butterfat. The highest producing Dutch Belted cow, Loraine No. 3020, produced 18,211 pounds of milk and 816 pounds of fat.

PEDIGREE

A pedigree describing the ancestors of an animal may be very helpful in selecting dairy cattle. Only a small percentage of all dairy cattle are purebreds, and the pedigrees of grade animals are not usually available. Following is a partial pedigree for a bull owned by Carnation Farms, Seattle, Washington:

PUREBRED
HOLSTEIN-FRIESIAN
BULL
Born December 5, 1951

His 7 nearest dams average:

Fat 365 days	832.10
Milk	22307.00

The sire is a son of the Gold Medal Proven sire, Hallrose Progressor, from an 874 lb. daughter of a 1066 lb. full sister to the three time All-American champion, Carnation Governor Imperial. The reserve champion dam made up to 973 lbs. fat in a year and is by a Res. All-Time All-American son of "Imperial," from a daughter of a 767 lb. Sr. 4-yr.-old.

Sire: CARNATION PROFESSOR
1054493

His five nearest yearly tested dams average:

Fat 365 days	959.90
Milk	24151.00

1st prize Jr. Yrlg., Pacific International, 1949.
1st prize Jr. Yrlg., Western Washington Fair, 1949.
2nd prize 2-yr.-old, Pacific International, 1950.
2nd prize 2-yr.-old, Western Washington Fair, 1950.

Dam: CARNATION MAY BESS BONNIE
2194538

Fat 365 d 5y	973.00
Milk (4X–3.8%)	25509.00
Fat 365 d 2y	587.90
Milk (3X)	16378.00

Res. Grand Champion, Michigan State Fair, 1941.
1st prize Sr. Calf, Michigan State Fair 1941.
2nd prize Sr. Calf, National Dairy Show, 1941
3rd prize Sr. Calf, Waterloo, 1941.

PRODUCTION RECORDS

The production records of a purebred animal and of its ancestors appears on the pedigree, as shown in the previous paragraphs. An

increasingly large number of our dairy herds are being tested in dairy herd improvement association programs. During 1951 more than 540,000 lactation records were reported by the dairy herd improvement association supervisors in the United States. A large number of purebred cows were on official tests that were supervised by the various breed associations. It is not difficult to find breeding stock with production records or from sires and dams with production records. This information takes much of the guesswork out of dairy cattle selection.

Proven Sires. The Bureau of Dairy Industry began, in 1936, a sire-proving program and in 1951–1952, 2414 dairy sires were proved. Wisconsin, Pennsylvania, New York, Iowa, and Minnesota lead the states in number of bulls proven. More than two hundred sires were proven in each of these states.

To prove a bull, the production of at least five daughters is compared with the production of their dams. This information is very helpful in buying both male and female breeding stock.

Testing the Home Herd. Only a small percentage of our dairy cows are in DHIA herds because of the cost of the program, and because of shortages of DHIA supervisors. Some dairymen, too, have not been sold on the testing program. What methods can the small dairyman use in making his own tests? In the main, there are two methods: (1) He can cooperate with the local DHIA in an owner-sampler testing program, or (2) he can take his own samples and do his own testing, using equipment owned privately, cooperatively, or owned by the local school or extension service.

Owner-sampler testing. County-wide dairy herd improvement cooperatives with central laboratories for testing milk and keeping records are the answer to the need for more record keeping at lower costs. The owner-sampler records are based on a one-day test each month. The supervisor leaves sample bottles, barn sheets, and scales at several farms each day. Each dairyman records the weight and takes a composite sample of the evening and morning milk from each cow. The association supervisor picks up the samples and weight records and takes them to the laboratory where the samples are tested and the records are computed for each cow. The completed records are mailed to the dairyman and are discussed with him by the supervisor on the next trip to the farm. This system provides accurate testing and record keeping at a low cost since one supervisor can handle several herds in one day.

The Babcock Test. An individual dairyman can weigh the milk from each cow, each milking, during one day of each month, and take a composite sample and make his own tests if equipment is available. Facilities are usually available in the vocational agriculture department of the school or in the office of the agricultural extension director. The following suggestions are in order in making home tests by use of the Babcock test:

1. Weigh the milk from each cow for each milking during one day.
2. Take from each milking a small sample of milk. The same amount of milk should be taken from each milking.
3. Mix the samples to make a composite test.
4. Warm the thoroughly mixed sample to 65° or 70° F.
5. Draw milk into the pipette until it is level with the 17.6 cc. mark.
6. Discharge the milk from the pipette to the test bottle, being careful that every drop of milk is transferred to the bottle.
7. Add slowly, as the test bottle is being tilted and rotated, 17.5 cc. of cold commercial sulphuric acid. Adding about 50 per cent of the acid and mixing it with the milk before adding the other half is recommended.
8. Mix the acid with the milk by rotating the bottle. Do not shake bottle or hold finger over the opening.
9. Place the mixed samples in the centrifuge tester. Space them properly to balance the centrifuge.
10. Whirl the centrifuge for five minutes at the speed indicated on the machine.
11. Add warm, soft water to bring the contents of each bottle up to the base of the bottle neck.
12. Centrifuge for two minutes.
13. Add water carefully, using a pipette, bringing the fat column up into the graduated scale of the bottle neck. Centrifuge for one minute.
14. Place the bottles in a water bath at 130° to 140° F. for 5 minutes.
15. Read the test by using dividers to get the height of the fat column, then lower them, placing one divider at 0; the other divider will indicate the butterfat test.
16. The reading is made from the extreme top of the top meniscus to the extreme bottom of the lower meniscus.

17. The weight of milk multiplied by the butterfat test, times the number of days in the month, will indicate the monthly butterfat production of the cow.

The BDI detergent test. Numerous attempts have been made to replace the Babcock butterfat test, which involves the use of concentrated sulfuric acid. The Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture has developed a test which involves the use of detergents and methyl alcohol. The test is easy to make, and the results check closely with those obtained with the Babcock method. Although the test is still experimental, it shows much promise. The test has not been approved for official testing but appears to have a place in the testing programs of individual dairymen and of vocational agriculture students.

Materials Needed. *Chemicals.* (A) 7.0 g. of sodium tetraphosphate and 3.0 g. of Triton X–100 made up to 100 milliliter (approximately ⅘ of a pint) of solution with distilled water. (B) 50 per cent methyl alcohol (chemically pure).

Equipment. The same equipment is used in testing milk by the detergent method as is used when the sulfuric acid test is made. The test bottle, pipette, centrifuge, calipers, and water bath are the same.

Procedure.

1. As is done when a Babcock test is made, the milk is thoroughly mixed and heated to 20° C. before a sample is taken.
2. With a pipette transfer 18 g. of the prepared sample of milk to the test bottle. Blow out the milk in the pipette tip after free overflow has ceased.
3. Add to the test bottle 5.0 ml. of chemical solution A. Turn the neck of the bottle as the solution is being poured so that all traces of milk will be washed into the bottle.
4. Shake the bottle to mix but avoid spilling any of the contents.
5. Place the bottle in a bath of boiling water with the water level with the level of the milk in the bottle.
6. After about five minutes remove the bottle from the water bath and shake to remix the raised cream with the solution.
7. Replace the bottle in the bath and leave it there for at least ten minutes. The total heating time should be fifteen minutes in water that is boiling. The sample may be shaken again

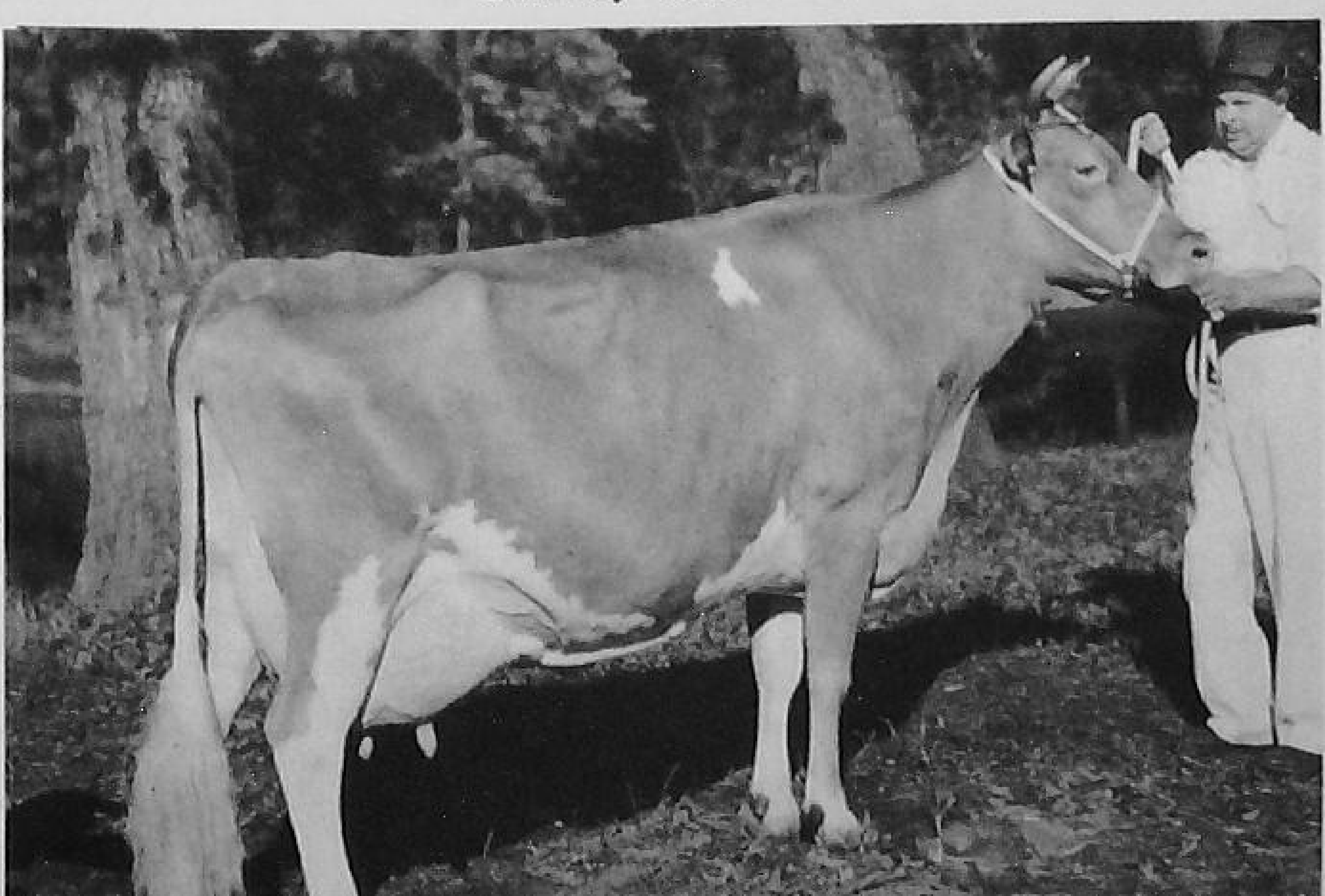
to remix if some of the cream has risen to the surface and escaped the reaction. Allow at least five minutes in the bath after the last shaking.

8. Remove the bottle from the hot bath and add 50 per cent methyl alcohol until the solution comes to the top of the graduated scale on the neck of the bottle. Allow the alcohol to run down the side of the neck of the bottle.
9. Place the bottle in an unheated centrifuge and rotate the centrifuge for two minutes.
10. Remove the bottle from the centrifuge and place it in a warm water bath maintained at 55° to 60° C. Immerse the bottle until the water level is level with the top of the fat column in the neck of the bottle.
11. Leave the bottle in the water bath for about fifteen minutes or until the fat column is well defined.
12. Remove the bottle from the bath and, with the aid of dividers or calipers, measure the fat column, in terms of percentage by weight, from the lower surface of the fat column to the highest point of the upper meniscus.

PHYSICAL APPEARANCE

It has been found that certain physical characteristics in cattle are associated with high production. An understanding of these

FIGURE 161. *Grand Champion Guernsey Cow at the 1949 and 1951 National Guernsey Show. Note the angularity, the lean neck, well-defined withers, and prominent hip bones. (Strohmeyer & Carpenter photo. Courtesy American Guernsey Cattle Club.)*



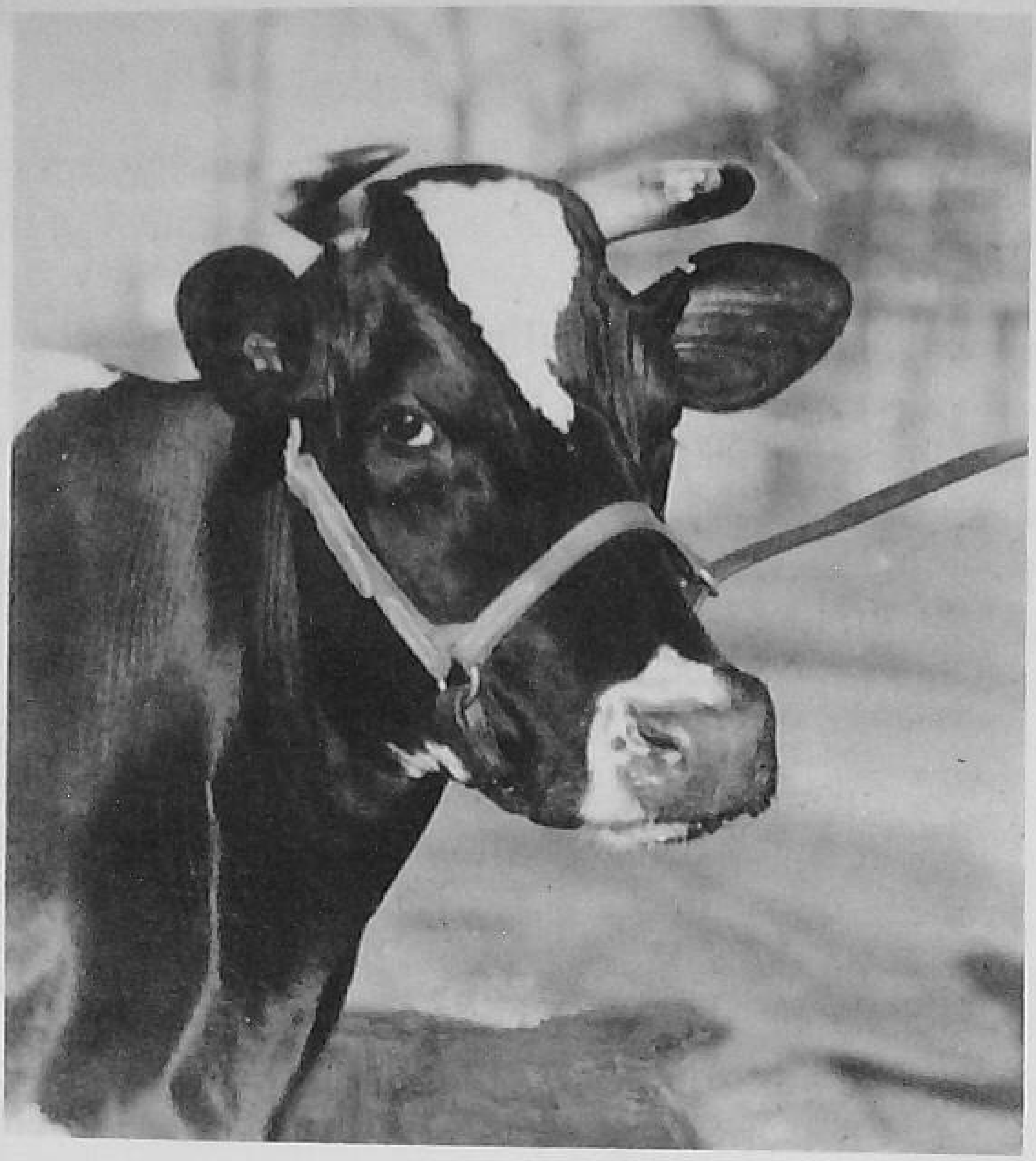


FIGURE 162. *The head and neck of this Holstein cow show excellent dairy character. (Strohmeyer & Carpenter photo. Courtesy Holstein-Friesian Association of America.)*

characteristics makes it possible for us to judge the productive capacity of an individual for which production records are not available.

Dairy Cow Score Card. The five dairy breeds of this nation through the medium of the Purebred Dairy Cattle Association have prepared score cards for dairy cows and bulls. The score cards have been approved and made official by the five dairy breeds.

DAIRY COW SCORE CARD
(Based on Order of Observation)

1. General Appearance (30 Points)

Attractive individuality, revealing vigor, femininity with a harmonious blending and correlation of parts; impressive style and attractive carriage with a graceful walk.

Breed Characteristics—Color, size and horns characteristic of the breed.

Head—medium in length, clean cut; broad muzzle with large open nostrils; lean, strong jaw; full, bright eyes; forehead broad between the eyes and moderately dished; bridge of nose straight; ears of medium size and alertly carried.

Shoulder Blades—set smoothly against chest wall and withers, forming neat junction with the body.
Back—strong and appearing straight with well-defined vertebrae.
Loin—broad, strong, and nearly level.
Rump—long, wide; top line level from loin to, and including, tail head.
Hips—wide, approximately level laterally with back, free from excess tissue.
Thurls—wide apart.
Pin Bones—wide apart and slightly lower than hips, well-defined.
Tail Head—slightly above and neatly set between pin bones.
Tail—long and tapering, with nicely balanced switch.
Legs—wide apart, squarely set, clean cut, and strong with forelegs straight.
Hind Legs—nearly perpendicular from hock to pastern. When viewed from behind, legs wide apart and nearly straight. Bone flat and flinty, well-defined tendons. Pasterns of medium length, strong and springy. Hocks cleanly molded.
Feet—short and well-rounded, with deep heel and level soled.

2. Dairy Character (20 Points)

Animation, angularity, general openness, and freedom from excess tissue, giving due regard to period of lactation.

Neck—long and lean, blending smoothly into shoulders and brisket; clean-cut throat and dewlap.
Withers—well-defined and wedge-shaped, with the dorsal process of the vertebrae rising slightly above the shoulder blades.
Ribs—wide apart; rib bone wide, flat, and long.
Flank—deep, arched, and refined.
Thighs—incurving to flat from the side, wide apart when viewed from the rear, providing sufficient room for the udder and its attachment.
Skin—of medium thickness; loose and pliable; fine hair.

3. Body Capacity (20 Points)

Relatively large in proportion to size of animal, providing ample digestive capacity, strength, and vigor.

Barrel—deep, strongly supported, ribs wide apart and well-sprung; depth and width tending to increase toward rear of band.
Heart Girth—large, resulting from long, well-sprung fore ribs, wide chest floor between front legs, and fullness at the point of elbow.

4. Mammary System (30 Points)

A capacious, strongly attached, well-carried udder of good quality, indicating heavy production and a long period of usefulness.

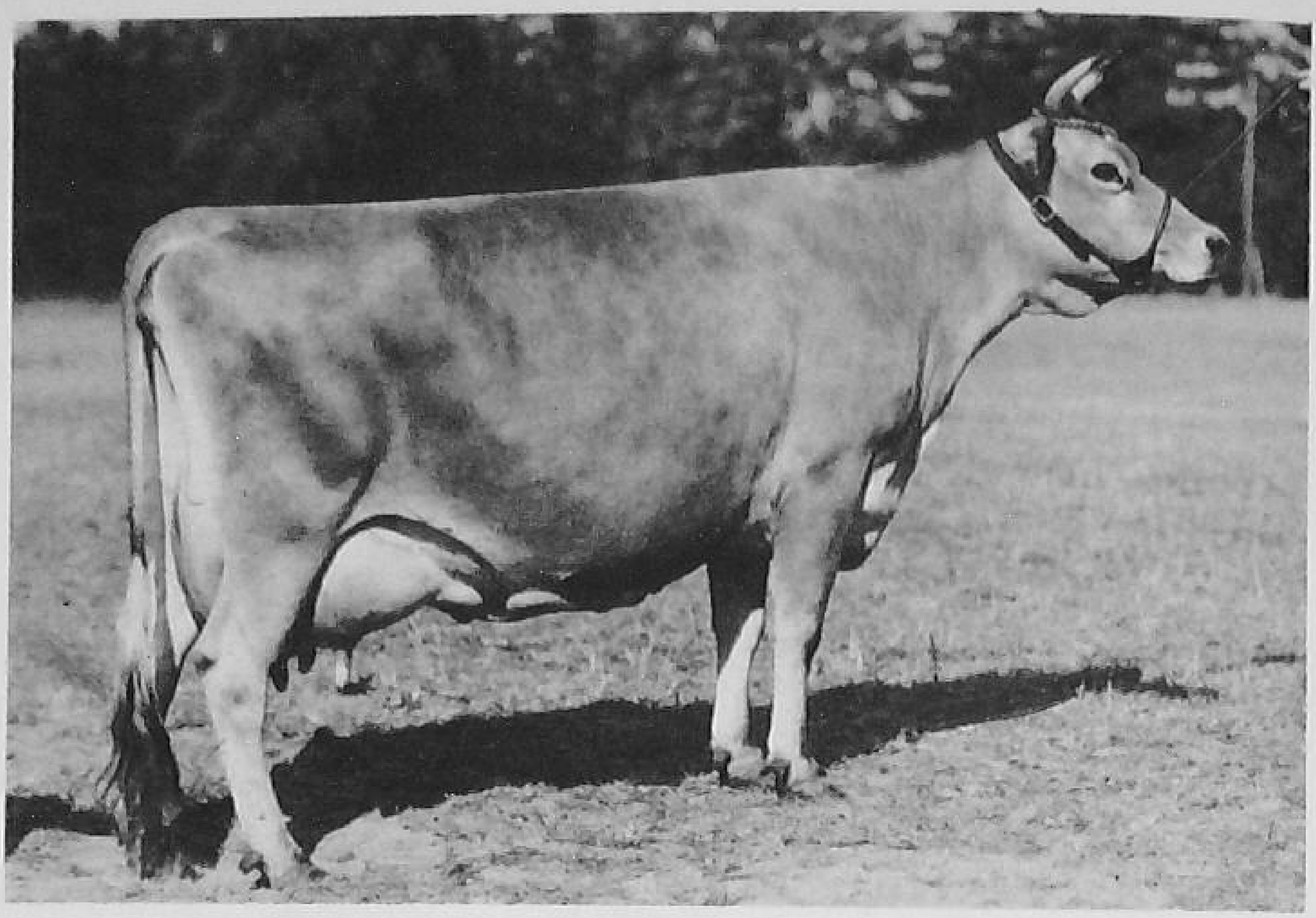
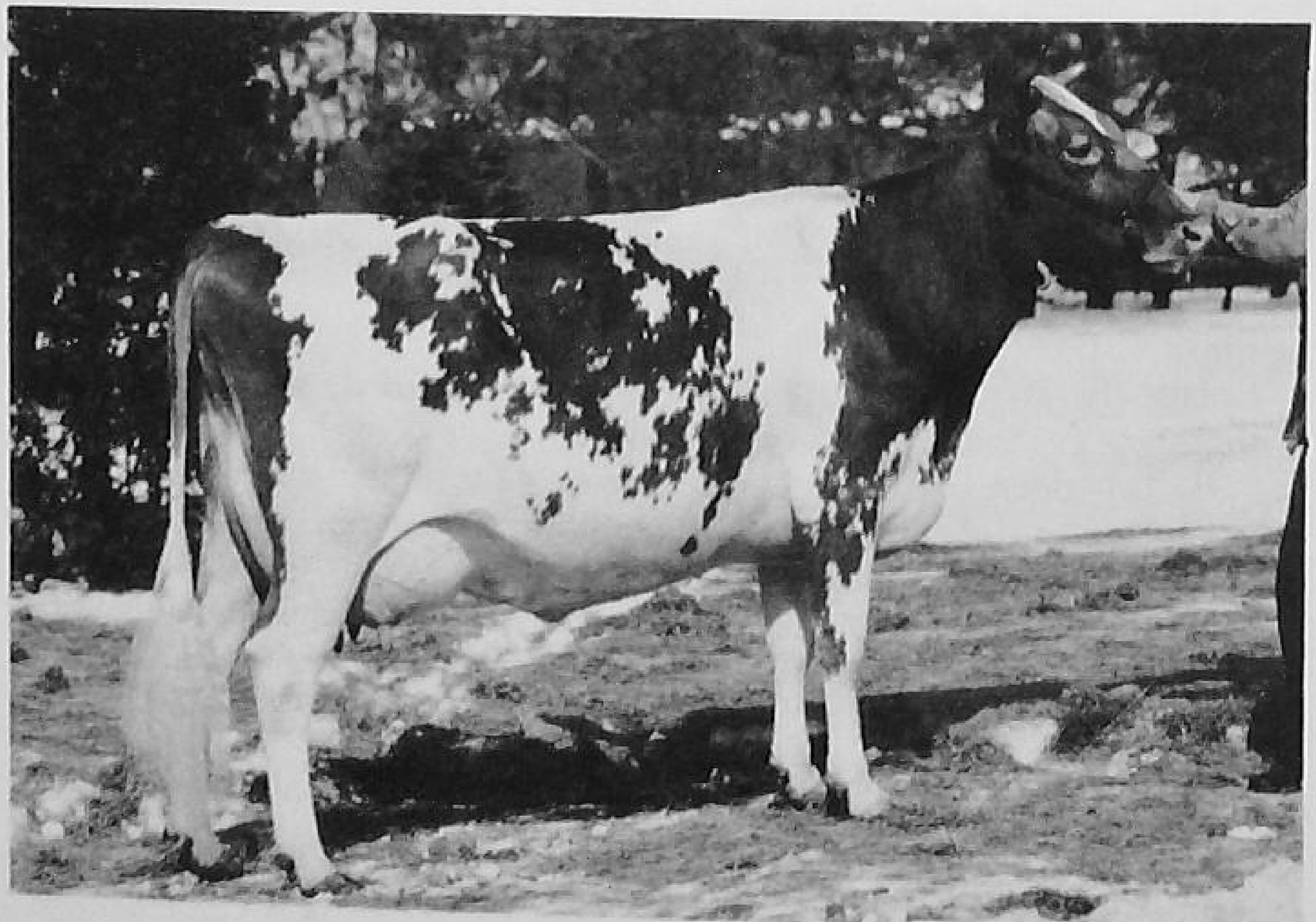


FIGURE 163. *This Jersey cow produced 17,222 pounds of milk and 1004 pounds of butterfat in one year. She has excellent digestive capacity as a result of having a long, deep, and wide barrel. (Strohmeyer & Carpenter photo. Courtesy American Jersey Cattle Club.)*

FIGURE 164. *Senior and Grand Champion and Best Uddered Cow at the 1950 National Guernsey Show. Note the excellent fore and rear attachment of the udder, and the evenly balanced quarters. (Strohmeyer & Carpenter photo. Courtesy American Guernsey Cattle Club.)*



Udder-Capacity and Shape—long, wide, and of moderate depth; extending well forward, strongly attached, reasonably level floor; rear attachment high and wide; quarters evenly balanced and symmetrical.

Texture—soft, pliable, and elastic; well-collapsed after milking.

Teats—uniform, of convenient length and size, cylindrical in shape, free from obstructions, well-apart, and squarely placed; plumb.

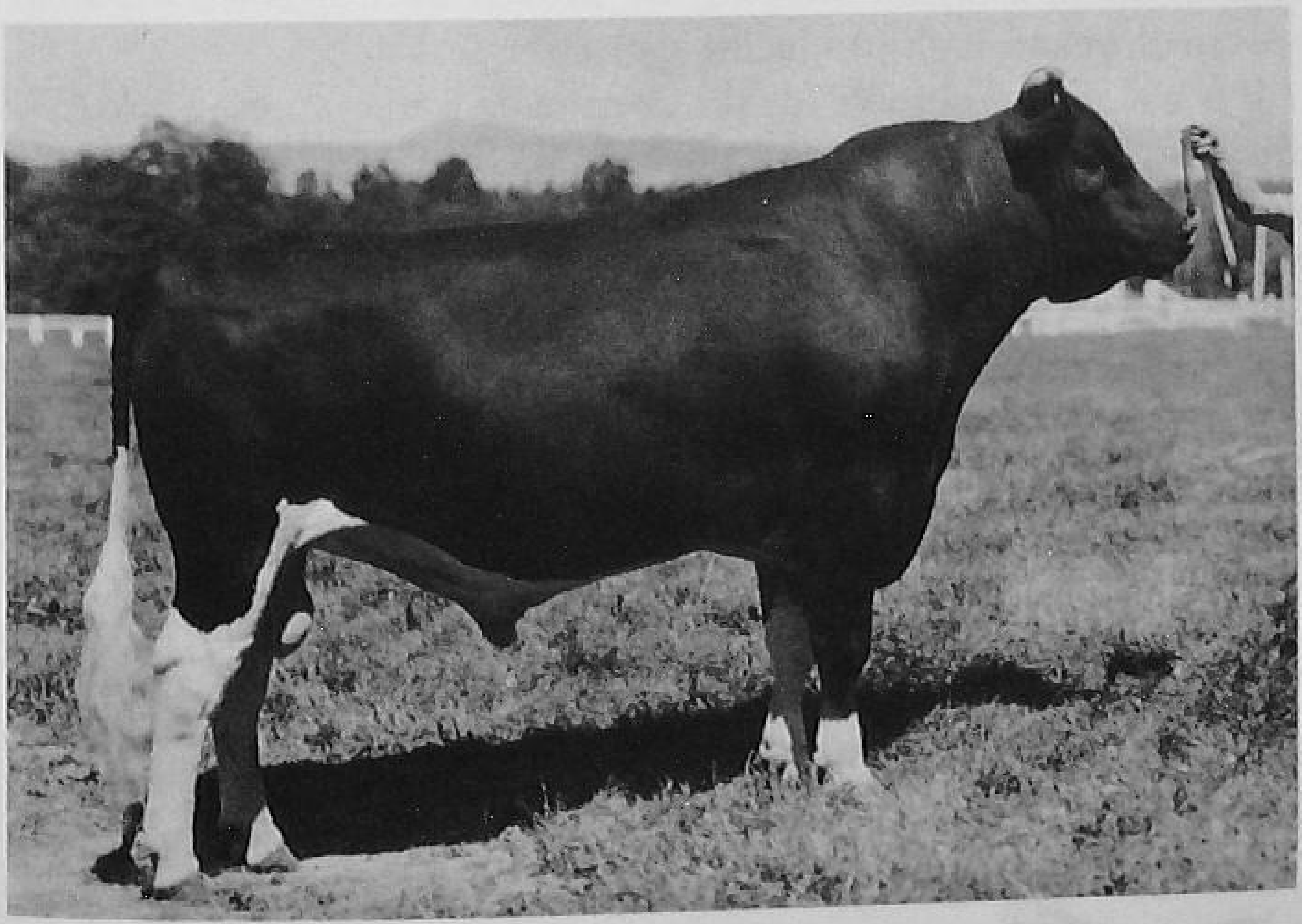
Mammary Veins—long, tortuous, prominent, and branching, with numerous large wells; veins on udder numerous and clearly defined.

Selecting Dairy Bulls. We desire in dairy bulls much the same characteristics desired in dairy cows, but greater emphasis is placed upon the production records and pedigrees of their ancestors. A bull is half the herd. He must be selected very carefully.

General appearance. A dairy bull should be large for its age, attractive, show masculinity, and have balance in type and conformation. He should have a long, clean-cut, masculine head with bright prominent eyes and a large muzzle.

He should have a straight top line, be long in body, and long and level in the rump. The tail setting should be smooth. Width

FIGURE 165. *Hallrose Hazel Pride 1050261, Grand Champion, Pacific International and Evergreen State Fair, 1951. Owned by Carnation Farms. (Strohmeyer & Carpenter photo. Courtesy Carnation Milk Farms.)*



of body at the fore rib, loin, hips, and pin bones is desired. In addition, the bull should possess the characteristics of the breed.

Dairy character. Dairy bulls are angular in conformation rather than rectangular. They should be fairly sharp over the withers and smooth in the thighs. The neck should be long, lean, and masculine. There should be no tendency toward beefiness.

The skin should be mellow, loose, and pliable, and the animal should have a fine hair coat.

The rudimentary teats should be well spaced and wide apart. The testicles should be normal in size.

Body capacity. A long, wide, deep barrel is desired. Width between the front legs and spring of fore rib is necessary. Dairy animals must be able to consume large quantities of roughages.

Feet and legs. Sound feet and legs are very necessary in dairy animals and especially so in the case of bulls. Bulls need straight legs, set out on the corners. The pasterns should be strong and springy.

Disposition. A bull that is active is desired, but nervous and mean animals ought to be avoided. The disposition of the bull determines the methods which may be used in handling him and may determine the use of which may be made of him in the herd.

Pedigree and record. Methods of artificial insemination have made it possible to make more effective use of proven bulls. Most bulls in use in artificial breeding are proven sires or trace back to proven sires and high producing dams.

It is not always possible for the average dairyman to use a proven sire. In areas where artificial insemination facilities are not available, it may be necessary to select outstanding sons of proven sires with desirable ancestors in the pedigree.

SUMMARY

The four criteria in selecting dairy animals are breed, pedigree, production record, and physical appearance. It is better to consider several of the criteria than any one alone.

The five most common breeds of dairy cattle ranked according to numbers available in the United States are (1) Holstein-Friesian, (2) Guernsey, (3) Jersey, (4) Ayrshire, and (5) Brown Swiss. Holstein cows lead all breeds in milk and butterfat production, but the milk is low in butterfat content. The milk of Jersey and Guernsey leads in quality, color, and butterfat content. Ayrshires

are more rugged than Jerseys and Guernseys, and are noted for their style and conformation.

Brown Swiss and Holstein are the most rugged of the breeds, and the Jersey and Guernsey cattle are the most refined. Brown Swiss cattle have been greatly improved during recent years.

There is no best breed of dairy cattle, but an individual dairyman may select a best breed for his farm and market conditions.

The pedigree, production record, and physical appearance are the determining factors in selecting dairy animals. Dairy animals should be angular, have sharp withers, smooth thighs, sharp hip and pin bones, and have long dished faces. Body capacity is important in selecting both cows and bulls. Width, depth, and length of body are essential. Dairy temperament is shown by angularity, leanness of neck, absence of beefiness, and quality of skin and hair.

A good mammary system includes a large udder with good fore and rear attachment. The teats are normal in size and properly spaced, and the udder is mellow, possessing no meaty tissue. The milk veins are large and crooked and lead to large milk wells.

Masculinity, breed character, dairy temperament, and a strong constitution are essential in selecting dairy bulls.

Production records and pedigrees of the individual and of the ancestors should be evaluated in selecting dairy animals. A comparison is made of the production of five daughters with that of their dams in proving a bull.

QUESTIONS

1. Which of the following factors should be given most consideration in selecting dairy animals, breed, pedigree, production record, or physical appearance? Why?
2. List the most common dairy breeds, and outline the advantages and disadvantages of each.
3. Which of the dairy breeds is best adapted to your home farm? Why?
4. What factors should be considered in selecting dairy cows by their physical appearance?
5. Which is most important in a dairy cow—the general appearance, the body capacity, the dairy temperament, or the mammary system? Why?
6. Describe the ideal mammary system on a Guernsey cow.
7. Survey your home county, and determine the number of herds of dairy cattle for which production records are available.

8. In proving a sire, is it necessary that the milk production of the daughters be higher than that of their dams? Why?
9. Outline the plan which you will use on your home farm in improving your herd through selection.
10. In selecting a bull, what factors will you consider which are not considered in selecting dairy cows?

REFERENCES

Anderson, Arthur L., *Introductory Animal Husbandry*, The Macmillan Company, New York, 1951.

Eckles, and others, *Dairy Cattle and Milk Production*, The Macmillan Company, New York, 1939.

Holstein-Friesian Association of America, *The Judging Manual*, Brattleboro, Vermont, 1948.

Petersen, W. E., *Dairy Science*, J. B. Lippincott Company, Philadelphia, 1950.

Smith, W. W., *Elements of Livestock Judging*, J. B. Lippincott Company, Philadelphia, 1946.

U. S. Department of Agriculture, *Dairy Cattle Breeds*, Farmer's Bulletin 1443.

Zavoral, H. G., and Chase, C. C., *Livestock Judging for Beginners*, Extension Bulletin 211, University of Minnesota, 1947.

< 18 >

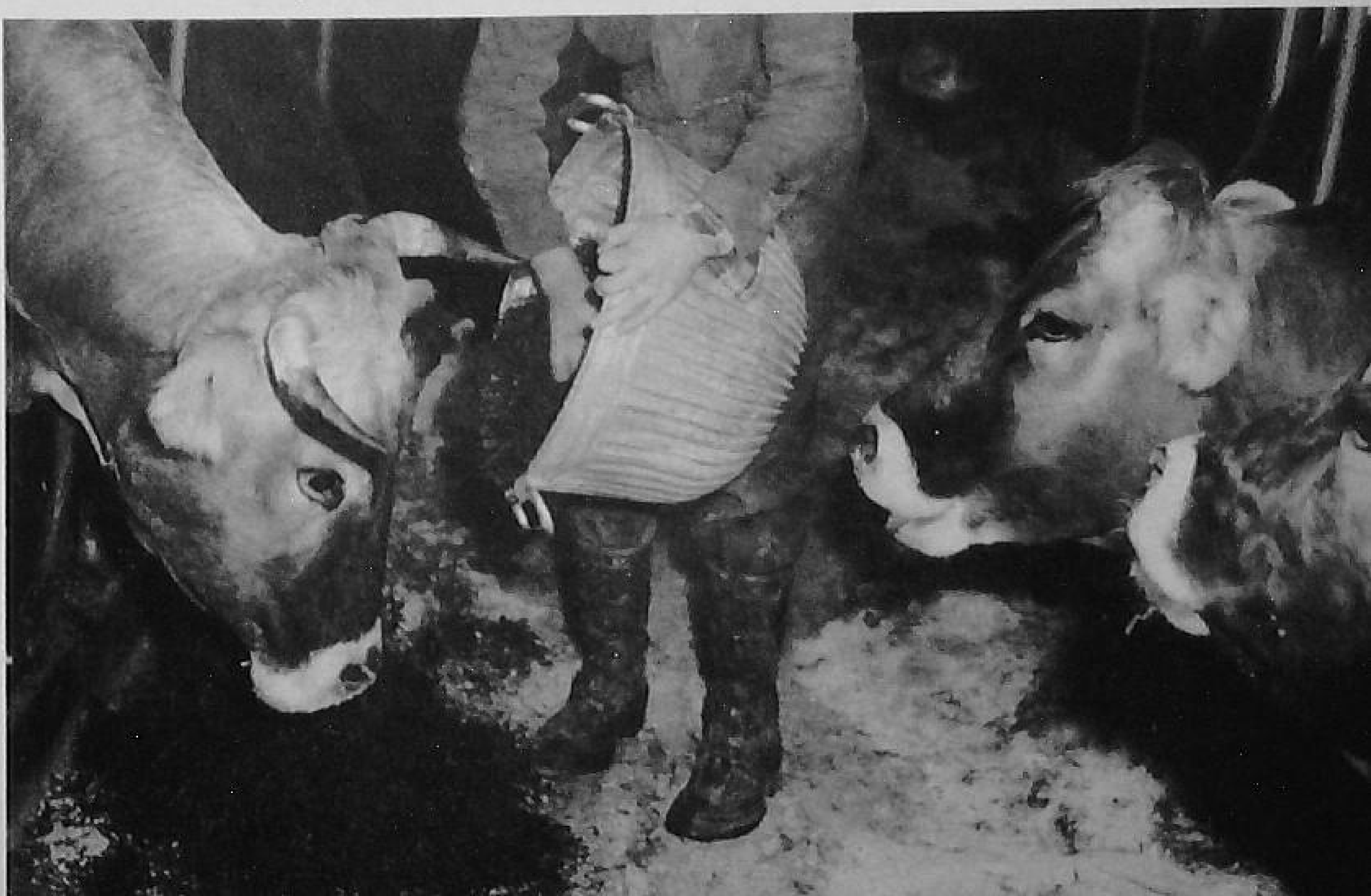
Feeding and Management of Dairy Cows

The dairy cow may well be termed "a factory." As in the factory, raw materials must be supplied if a useful finished product is to be produced. The dairy cow will take the raw products of the farm—hay, fodder, silage, and grass—and convert them into a nearly perfect food which we know as milk. How efficiently the cow will produce depends upon breeding, feeding, and management. The importance of breeding for production was discussed in Chapter 17. Feeding and general management will be discussed in this chapter.

FEEDS FOR THE DAIRY COW

Dry Roughages. Dairy cattle are efficient users of roughages. When the ration is properly balanced, dairy cows will convert into milk large quantities of relatively inexpensive roughages.

FIGURE 166. *Legume-grass silage provides good roughage for dairy cows. (Courtesy* Wallaces' Farmer and Iowa Homestead.)



Legumes. Legumes lead the field as roughages for dairy cattle, with alfalfa at the top of the list. *Alfalfa* is unexcelled as a dry roughage, being high in protein and total digestible nutrients. *Red clover*, if cut before the blossoms turn brown, ranks only slightly below alfalfa as a dry roughage for dairy cows. Other clovers, lespedeza, and soybeans make very good roughage for dairy cows. When legumes furnish the bulk of the roughages fed, a considerable saving in protein concentrates will result. Legumes will minimize the risk of vitamin and mineral deficiencies because they are high in these nutrients.

Nonlegume hays. Native grasses, brome, timothy, and many others will provide forage. However, the grasses are considerably lower than legumes in protein and in some of the minerals and vitamins. When nonlegume hays are used extensively, greater care will need to be exercised to be sure the ration is balanced.

Corncobs, cornstalks, and straw. All these roughages are low in protein, minerals, and vitamins. Although they may be used under certain conditions for beef cattle feeding, their value is doubtful as a feed for dairy cattle. The good milk cow must consume large amounts of highly digestible feed if she is to maintain production. Sixty to 70 per cent of the total digestible nutrients should be provided by roughages for profitable production under most conditions. When low quality forages are used, the capacity of the cow is not sufficient to allow for a large enough feed intake to maintain high milk production. Considering everything, most dairymen agree that high quality forage, like legumes and good silage, are the cheapest feeds.

Corn or sorgo silage. Corn and sorghum crops make excellent roughages for dairy cattle. However, the protein content of these silage crops is low, requiring additional amounts of protein meals to balance the ration. If well-eared corn or grain sorghum silage is fed, less grain otherwise will be required because considerable grain will be contained in the silage.

Legume and grass silage. More dairymen are using legume and grass silage as a dairy feed each year. Very little protein is lost when these crops are made into silage. Most Midwest farmers find it extremely difficult to get the first crop of alfalfa put up without being rained on when it has to be field-cured. As a result, many have turned to the trench silo or silage stack as a means of preserving the crop. When the silage is made from legumes or a

FIGURE 167. *Good pasture simplifies the summer feeding problem. (Strohmeyer & Carpenter photo. Courtesy Ayrshire Breeders' Association.)*

mixture with a high percentage of legumes, the feed is very nutritious. Legume silage is high in nearly all the food nutrients.

Pastures. The natural feed for the dairy cow is pasture. The pasture season should be made as long as possible. Fall-seeded rye provides early spring pasture, which may be followed by native grasses or legume-grass mixture. Sudan grass or a sudan grass-soybean combination makes an excellent summer and early fall pasture. In general a legumes-grass combination provides the most grazing per acre of highly nutritious forage of any common pasture crops. Pasture mixtures recommended for beef cattle (see Chapter 13) are also recommended for dairy cattle. Straight legume pastures should be avoided because they are apt to be a bloat hazard. The plant stand should be at least half grass. Many dairymen are finding the ladino clover, alfalfa, and brome combination highly successful in meeting high production records at relatively low feed cost. Good pasture crops provide a reasonably well-balanced ration in themselves.

Grains. Farm grains are high in carbohydrates and relatively high in fats. They are fed largely for their energy value. However, grains provide some of the essential minerals, vitamins, and protein.

Corn. Corn is palatable and very nutritious as a feed for dairy cows. Throughout the corn belt it is considered the most important grain for dairy production.

Grain sorghum. Grain sorghum may be substituted for corn, pound for pound, in the dairy ration. The nutrient content of the sorghum grains is very similar to that of corn.

Wheat. Wheat is equal to corn in food value, but because of its gluten content it becomes pasty when eaten, unless mixed with other feeds. Wheat should not make up much more than half of the grain ration. Wheat is higher than corn in protein.

Ground ear corn. Ground ear corn has about 90 per cent of the feed value of ground shelled corn. However, many dairymen prefer ground ear to shelled corn. Probably the chief advantage lies in the labor saved in shelling corn.

Oats. Oats, an excellent grain for cows, are somewhat less digestible than corn, but they have a higher protein content. Pound for pound oats equal about 90 per cent of the value of corn for dairy cattle.

Barley. Barley, which may be used to replace corn, is the chief grain fed to many dairy herds. Barley has about 95 per cent of the value of corn on a pound for pound basis for dairy cows.

Rye. Rye is unpalatable to dairy cows. In food value it is about equal to barley. It should not be used to make up more than one-fourth of the grain ration.

Beet pulp. Beet pulp is the residue of sugar beets after the sugar has been removed. Beet pulp is often referred to as a roughage, but in nutrient composition it is more nearly like the grain concentrates. Beet pulp carries about 88 per cent as much total digestible nutrients as corn but is lower in protein. Its value should be figured on the cost per pound of digestible nutrients.

Wheat bran. Wheat bran is a by-product resulting from the processing of wheat into flour. It is composed primarily of wheat hulls and is a very common dairy feed. It is laxative and fairly rich in protein. Bran compares favorably with oats in total digestible nutrients.

Grinding grain. Grinding grain for dairy cows increases the digestibility and reduces waste. When grains are fed without grinding, a large percentage passes unacted upon through the digestive tract. Grains should not be ground too finely, because they become pasty in the mouths of cattle and are unpalatable.

Protein Supplements. The oil seed meals make up the bulk of common protein supplements fed to dairy cattle. The meal is the

residue after the oil has been extracted. Soybeans, flax, and cottonseed are the more common oil seed crops.

Soybean oil meal. Soybean oil meal ranges from 40 to 47 per cent protein and is an excellent source of protein for dairy cattle.

Cottonseed meal. Cottonseed meal ranks high among the protein meals for cattle.

Linseed oil meal. Linseed oil meal is an old standby and is well liked by dairymen as a protein supplement.

Soybeans. Ground soybeans provide an excellent source of protein. Generally the price is too high to make them an economical feed.

Urea. Urea is a nitrogen compound which can be converted into protein by the bacteria in the rumen of cattle, goats, and sheep. When urea is fed, 1 pound mixed with 6 pounds of grain will replace 7 pounds of the oil seed meals. It should be remembered that urea, if fed in too great quantities, will cause considerable difficulty. Urea should not exceed 3 per cent of the concentrate mixture or 3 pounds in 100 pounds of concentrates. A cow receiving 10 pounds of concentrates daily would be limited to .3 pound of urea. It is important that good mixing facilities be available if urea is to be fed. If urea is not evenly mixed in the concentrates there is considerable danger that some cows may get too much. The maximum safe limit is .3 pound per cow per day.

If good legume hay is available, all the protein in the ration could be replaced with urea.

Other protein feeds. Corn gluten meal, corn gluten, and distillers grains are good sources of protein for cattle but are somewhat lower in percentage of protein than the meals made from the oil seed crops.

Vitamins. When dairy cows have access to good pasture during summer, and are fed liberally on good roughage during the winter, there is seldom any need for vitamin supplements. The group of vitamins known as the B complex are manufactured in the cow's paunch. Vitamins A and D are found in many protein supplements. Very inferior rations could cause a deficiency in vitamins A and D. Fish liver oils are high in vitamins A and D but may reduce the fat content of the milk when fed to cows in production. If a need for these vitamins exists, a prepared vitamin concentrate for cattle should be used.

Minerals. Phosphorus, calcium, and salt should be provided for the dairy herd. In some areas the soil is deficient in some of the trace minerals, such as iodine and cobalt. Since we cannot be certain whether a deficiency exists on the farm producing the feed, it is good insurance to provide a complete mineral mixture in the ration. One pound of mineralized salt (salt containing trace elements) and 1 pound of bone meal per 100 pounds of concentrate ration is used by many dairy men. The mineral mixtures recommended for beef cattle (see "Beef Cattle," Chapter 12) may be used successfully for dairy cattle.

Water. Milk contains about 87.2 per cent water. The water intake of a producing cow is important in determining her production. Clean fresh water located where the cows have easy access to it at all times is the cheapest way of increasing production. It has been pointed out that the dairy cow needs to consume an enormous amount of feed for high production, so proper digestion of the feed depends upon plenty of water.

FEEDING THE DAIRY COW

The dairy cow uses feed for (1) maintenance of her body, (2) development of her unborn calf, and (3) production of milk. About one-half of the daily ration consumed by the cow is used up for maintaining her body and nourishing her unborn calf. No matter what her milk flow may be, the maintenance cost will be the same for cows of equal weight. That is why good producing cows are so important for profitable production. The cow that produces only 200 pounds of butterfat in a year will consume about two-thirds as much feed as the cow producing 400 pounds of butterfat. It will take the entire milk check, under average conditions, to pay the feed bill for the 200-pound producing cow. The 400-pound producing cow will pay her feed bill and leave to the owner from 100 to 150 pounds of butterfat as profit.

Roughages Are the Basis of Dairy Rations. Cows can maintain themselves and produce a calf and a limited amount of milk on a full ration of good quality roughage and water. Roughages vary greatly in feeding value. A high quality roughage is one that has approximately the same total digestible nutrients as the second or third cutting alfalfa that has been harvested in the early bloom stage. Grain and protein supplements are added to the ration in

proportion to the amount of milk a cow produces over and above what can be produced from the roughage part of the ration.

Amount of Roughages Consumed by Cows. When dairy cows are fed all the dry roughage they will consume, they will eat approximately 2½ pounds per 100 pounds of live weight. Thus an 800-pound cow will consume about 20 pounds, while a 1200-pound cow will consume about 30 pounds. When high moisture roughages, such as silage, are fed they will consume about 2½ to 3 times as much by weight as when dry roughage is used, the difference being in the water that is taken in with the feed. Three pounds of silage equals about one pound of dry roughage in food value. Since the dairy cow's capacity is limited, the better the quality of roughage she gets the less grain will be required. The 1200-pound cow can maintain her body weight and nourish her unborn calf on 20 pounds of good dry roughage or 2 pounds per 100 pounds of body weight. Since the cow can consume about 30 pounds, she can produce about 15 pounds of milk daily, testing 3½ per cent on the additional 10 pounds of roughage. The amount of milk the cow may be capable of producing above 15 pounds has to come from the grain and protein supplement. If a roughage is fed that provides only two-thirds as much digestible nutrients as good hay, then it will require the entire 30 pounds for maintenance, and all the milk the cow produces will have to come from the concentrates. Since even good roughages are generally cheaper than concentrates, it is shown by the preceding examples how important roughages are to economical dairy production.

Determining the Amount and Kind of Concentrates to Feed. To feed properly a dairy cow in production the following information is necessary: (1) weight of the cow, (2) the amount and kind of roughage, (3) the daily milk production, (4) the butterfat test, and (5) the value of the product in relation to feed cost.

Weight of the cow in determining the amount of concentrates. The weight of the cow is important in determining the amount of feed required for maintenance and reproduction. It has been pointed out that 2 pounds of good dry roughage or 5 pounds of silage per 100 pounds of live weight will maintain the cow; also, she will eat ½ pound more of dry roughage or 1¼ pound more silage per 100 pounds body weight if made available to her. If the amount of forage is limited or the quality is poor, the difference will need to be made up by the concentrates.

Kind of roughage in determining amount of concentrates. The amount of total digestible nutrients and the kind of nutrients provided by the roughage must be considered in planning the amount and kind of concentrates. Some roughages, such as corn silage, are equal to legumes in total digestible nutrients but are low in protein. When low protein roughages are fed, the difference should be made up, to some extent, by protein concentrates. For example, a cow receiving 25 pounds of alfalfa hay would have enough protein to produce 40 pounds of milk if other nutrients were provided. A cow receiving 25 pounds of timothy hay would not have enough protein to maintain her body and reproduce. If timothy hay were the only roughage, enough protein supplement would have to be provided for her entire milk production, and more for body maintenance.

Concentrates for milk production. Since a cow will consume enough good roughage for maintenance and part of her milk production, any milk she produces over what the roughages will provide for must come from concentrates. The larger breeds of cows (Holstein, Brown Swiss, Ayrshires) can be expected to maintain their body weight and produce from 15 to 20 pounds of milk daily from roughages. The smaller breeds (Jerseys and Guernseys) can be expected to produce only from 10 to 15 pounds of milk daily from roughages alone.

The amount of concentrates to feed in relation to test. In feeding concentrates, the butterfat test of the milk that individual cows produce must be considered. It takes more feed to produce 30 pounds of 5 per cent milk than it does to produce 30 pounds of 3 per cent milk. Holsteins average about 3½ per cent; Ayrshires, Brown Swiss, and Shorthorns 4 per cent; Guernseys 5 per cent; and Jerseys 5½ per cent butterfat test.

Feeding concentrates according to profits. Except for cows on test for the purpose of making a high production record, it is seldom profitable to feed for maximum production. When the dairyman reaches the point where the value of the increased production is less than the cost of the feed, he is not getting economical production. For example, suppose a cow getting a full feed of alfalfa plus 10 pounds of concentrates is producing daily 40 pounds of 3½ per cent milk. If the owner increases the concentrates 5 pounds at a cost of 20 cents and secures a 2-pound increase in the milk, which is worth 7 cents per pound, he will be

spending 20 cents for a return of 14 cents. The concentrates should be increased until the cow has reached the maximum point of profitable production.

Concentrate Mixtures. The concentrate mixture depends largely upon the quality of roughage fed. Table 30 lists some recommended mixtures for various roughages.

TABLE 30

CONCENTRATE MIXTURES FOR DAIRY COWS

Kind of Roughage	*Concentrates*	*Pounds*	*Kind of Roughage*	*Concentrates*	*Pounds*
Good legume hay (full fed)	Ground ear corn Oats Soybean, linseed or cottonseed meal	600 300 50	Corn or sorghum silage full fed	Ground ear corn Oats Wheat bran Corn gluten meal Soybean meal	500 100 200 200 50
Good legume hay or Legume silage	Corn, barley, or sorghum Oats Soybean, linseed or cottonseed meal	500 400 50	Grass hay	Corn, barley, wheat or sorghum Oats Linseed meal	300 400 250
Mixed hay	Ground ear corn Beet pulp Oats 40% protein meal	300 100 100 100	Corn stover	Corn, barley, wheat or sorghum Oats Linseed or soybean meal	600 200 300

TABLE 31

AMOUNTS OF CONCENTRATE MIXTURE REQUIRED FOR DAIRY COWS THAT ARE FULL-FED HIGH-QUALITY ROUGHAGE

Breed	*Amount of Milk Cows Can Produce on Roughage Alone (pounds)*	*Pounds of Concentrate for Each Extra Pound of Milk*
Holsteins	20	.40
Brown Swiss	18	.45
Milking Shorthorns	16	.45
Ayrshires	16	.45
Guernseys	12	.55
Jerseys	10	.60

Rules for Feeding Producing Cows Not on Pasture. Several rules have been worked out to govern the amount of concentrates for dairy cows in production. For an average herd, getting all the

roughage it will consume, a concentrate mixture that will fit the quality of roughage should be selected and fed as follows: one pound for each 3½ pounds of milk testing below 4 per cent, and one pound for each 3 pounds of milk testing above 4 per cent. A more accurate method is described in Table 31. In the case of very low quality roughage, the rules do not apply. When roughage is unpalatable or so low in nutrients that the amount of food it supplies falls considerably below normal, more concentrates must be fed.

Feeding Cows in Production that Are on Pasture. Pasture is the most nearly perfect dairy feed available. The dairyman who has given careful attention to amount and quality of pasture crops is able to maintain high production at relatively low cost. Pastures have sometimes been likened to concentrates by feed specialists; this is correct in part. Young pasture grasses and legumes are high in protein, low in fiber, and high in moisture. The fiber content is the chief factor that determines whether a feed is a roughage or a concentrate. Young pasture grass contains about 18 per cent fiber as compared to good alfalfa hay with from 23 to 28 per cent and grains which run from 2 to 12 per cent.

Pasture crops are usually high in minerals, although the mineral content varies with the fertility of the soil. Phosphorus is most likely to be lacking in pastures. Occasionally, however, other essential minerals may be insufficient to meet the needs of the animals. When soils deficient in minerals are properly fertilized, the forage they produce will provide adequate minerals.

Vitamins are never a problem for cattle on good pasture. Vitamin A is found in abundance in green forage, and the sun will provide vitamin D.

Limitations of Pasture. Although good pastures are important in the economical production of dairy products, they have certain limitations. The limitations of pasture must be understood by the dairyman if he is to make the best use of pasture crops.

High water content limits the value of pasture. In the more humid areas, pasture grasses may run above 80 per cent water, especially in the spring. Since the cow's capacity is limited, she may not be able to consume enough to provide the nutrients needed for her milk production. The condition might be likened to a working man attempting to live on milk alone. Milk is a well-balanced food, but since it contains about 87 per cent water,

one doing hard physical labor would probably be unable to consume enough to provide for his nutrient needs. Successful dairymen usually provide some good dry forage and grain for high-producing cows on pasture.

Nutrient value of pasture varies. The nutrient value of pasture crops does not remain the same during the season. As plants become more mature, the fiber content increases and the protein content decreases. The same is true when the growth of plants is retarded because of dry weather. Many pastures that have provided most of the rations during one part of the season will need to be supplemented with additional forage and grain at other times if production is to be maintained.

Management of pastures to improve their value. Turning the cattle into the entire pasture area in the spring and leaving them there for the season is one of the most common mistakes in pasture management. The area is usually too large for the cattle to graze evenly. The sections that have been eaten off will grow up tender, and the cattle will continue to graze on these areas. As the season advances, the ungrazed portion becomes coarse, unpalatable, and low in food value, whereas the grazed areas are not adequate to provide enough forage. By using an electric fence and by limiting the cattle to a smaller area and rotating them every two or three weeks, more and better grazing will be provided per acre of pasture land.

Feeding concentrates on pasture. When pastures are good and cows can get their fill in two to three hours of grazing daily, very little grain is necessary for average-producing cows. Jerseys and Guernseys will produce up to 30 pounds; Holsteins, Brown Swiss, Ayrshires, and Milking Shorthorns will produce 40 pounds of milk daily on pasture alone. Cows producing more than these amounts should be given one pound of grain for every 5 to 7 pounds of milk produced. The cows producing milk testing over 4 per cent should be fed more than those testing under 4 per cent. A Holstein cow producing 60 pounds of milk testing 3.5 per cent should be fed about 8½ pounds of grain daily, whereas a Jersey producing 40 pounds of 5 per cent milk would require 8 pounds of grain daily in addition to pasture.

Protein supplements on pasture. When good pasture is available, protein supplements are not necessary, except for very high-producing cows. To maintain the high protein content of pasture

throughout the season, it is advisable to have some legumes in the pasture mixture.

Feeding minerals and vitamins to cows on pasture. Except when pastures have been improperly fertilized and the soil is deficient in minerals, no minerals or vitamin mixtures are generally necessary except for salt. Iodized salt or salt containing iodine and trace minerals should be available at all times.

FEEDING AND MANAGING THE DRY AND FRESH COW

Drying-off Cows. The dairy cow needs from 45 to 60 days of rest between lactation periods. While she is dry, the cow should replace the body weight lost during the previous lactation period. Unless she has at least 6 weeks rest and a proper ration during the dry period, she will not be in condition for best production during the next lactation.

Frequently dairymen have considerable difficulty in drying-off high-producing cows. Three methods are used to dry up cows: (1) intermittent milking; (2) incomplete milking; and (3) abrupt cessation of milking. Of these three methods, the last has proven to be the best. Three days before milking is to be stopped all concentrates should be removed from the ration. The hay should be reduced to about one-half to two-thirds of the normal ration. The reduction in feed will reduce milk flow. Experiments have shown that milk will build up to a certain pressure and secretion will stop and reabsorption begin. It is recommended that after the last milking the teats be washed and dipped in collodion, which will seal the ends and prevent infectious organisms from entering the udder.

Feeding the dry cow. The dry cow must be put into the best possible condition by calving time. When milk secretion stops and the udder pressure is down, feeding concentrates should be started. The stored fat serves as a reserve supply to be drawn upon for milk production. Protein cannot be stored, so a ration with a protein content in excess of what the cow needs to put on flesh is not necessary. The amount of minerals, vitamin D, carbohydrates, and fats is important. There are hundreds of rations that may be used for conditioning dry cows. Good quality roughage and grains are important for putting on the most flesh in the shortest period of time. The following rations fed with dry roughage, silage, or pasture will serve as examples:

Ration 1	*Ration 2*
400 pounds corn and cob meal	200 pounds barley
100 pounds oats	200 pounds shelled corn
100 pounds bran	200 pounds oats
100 pounds linseed oil meal	100 pounds soybean meal

The amount of feed necessary depends upon the ability of the cow to produce and upon her condition when dried up. High-producing cows are usually thin and need to be full-fed during the rest period. Average-to-low producers will not lose a great deal of weight, and pasture or cured roughages are sufficient to recondition them.

Feeding Just Before Calving. A week or ten days before calving the grain should be reduced by one-half, and more bulk should be added to the ration. Reducing the concentrates may help to reduce the amount of udder congestion at calving time. The ration should be mildly laxative. Beet pulp is used by many dairymen as part of the ration during the last week of the rest period. Two examples of rations that may be used ten days before calving follow:

Ration 1	*Ration 2*
200 pounds ground oats	200 pounds oats
100 pounds wheat bran	100 pounds beet pulp
20 pounds linseed oil meal	25 pounds cracked soybeans

Feeding the Cow Just After Calving. The cow should be given all the warm fresh water she will drink after calving. For the next three or four days a light feed of bran and linseed meal, made up of six parts bran and one part linseed meal, and legume hay is all she should be fed. The bran and linseed may be moistened with water and sprinkled with a pinch of salt. If there is no serious congestion of the udder, the regular dairy ration may be started on the fifth day. The ration should be started at about 5 pounds and brought up to a full grain ration in about four weeks.

Milking the Cow After Freshening. Cows subject to milk fever should not be milked completely dry for the first four days after freshening.

DAIRY HERD MANAGEMENT

Age and Time to Breed. *Age to breed.* The size rather than the age of a dairy heifer at breeding time is important. Breeding young or undersized animals is never a profitable practice. They may be stunted or slow to reach maximum size. Small heifers are

more apt to have difficulty in calving. Table 32 gives the recommended ages and sizes to breed heifers.

TABLE 32

AGE AND SIZE TO BREED DAIRY HEIFERS

Breed	*Age*	*Weight*	*Heart Girth in Inches*
Holsteins	18 months	850–900	67
Brown Swiss	18 months	800–850	65
Ayrshires	18 months	750–800	64
Guernseys	17 months	700–750	62
Jerseys	16 months	600–650	59

Time to breed. Breeding the cows to freshen during the fall months (September, October, and November) is generally a more profitable practice. Fall freshening has the following advantages:

1. Greater milk production per cow. Cows freshening in the fall will hold up on milk production longer than will spring- or summer-fresh cows. The cow that was freshened in the fall will have a spring flush almost equal to a second freshening when she goes on grass.

2. Butterfat and milk prices are usually higher during the winter.

3. The farmer has more time during the winter, when he does not have to give his attention to crop production.

4. Fall calves are often stronger due to the excellent ration provided by good pasture. There is less danger of nutritional deficiencies in fall calves.

Artificial Insemination. Artificial insemination is a practice in which the semen of the bull is transferred to the cows by a person generally known as an *inseminator* or technician. The semen comes from bull studs or semen-producing centers and is shipped to local associations as needed.

How to get the service. Dairymen who want the service may join a cooperative association, which charges a membership fee and so much per cow for each cow served, or they may contact a private bull-stud center. Some veterinarians provide the service.

Advantages of artificial insemination. Artificial insemination, when properly administered, will give conception rates as high as those with the natural breeding method. Dairymen can secure the services of proven sires or those from a high-producing line at moderate cost. The bother of keeping a bull on the place is eliminated.

Disadvantages of artificial insemination. Probably the greatest disadvantage of artificial insemination is the inability of some operators to detect when the cows are in heat. Operators must observe the herd more closely than when a bull is available.

How to insure good results when breeding artificially.

1. Don't breed cows before sixty days following calving.
2. Know when the cow first appeared in heat and tell the technician.
3. Put the cow in the barn and leave her for four hours after breeding.
4. Keep accurate records of heat periods, breeding, and calving dates for all cows.
5. Call the technician in the morning before he starts on his route.
6. Breed cows during the end of the heat period.
7. Have hard-to-settle cows examined by a veterinarian.

Heat Periods. The average time between heat periods for cows is twenty-one days, but it varies from seventeen to twenty-six days. The heat period lasts from six to thirty-six hours, with an average duration of eighteen hours. The most common signs of heat are: (1) the cow is mounted by other cows or mounts other cows herself; (2) the cow is restless—doing a lot of moving around; (3) the vulva may be reddened and swollen. Some cows have what are known as *silent* heat periods. It is almost impossible to know when to breed cows that have silent heat periods.

Gestation period. The average gestation period for cows is 282 days. A variation of from seven to twelve days is not abnormal.

Cleaning the Cows. Cows in the milking herd should be kept

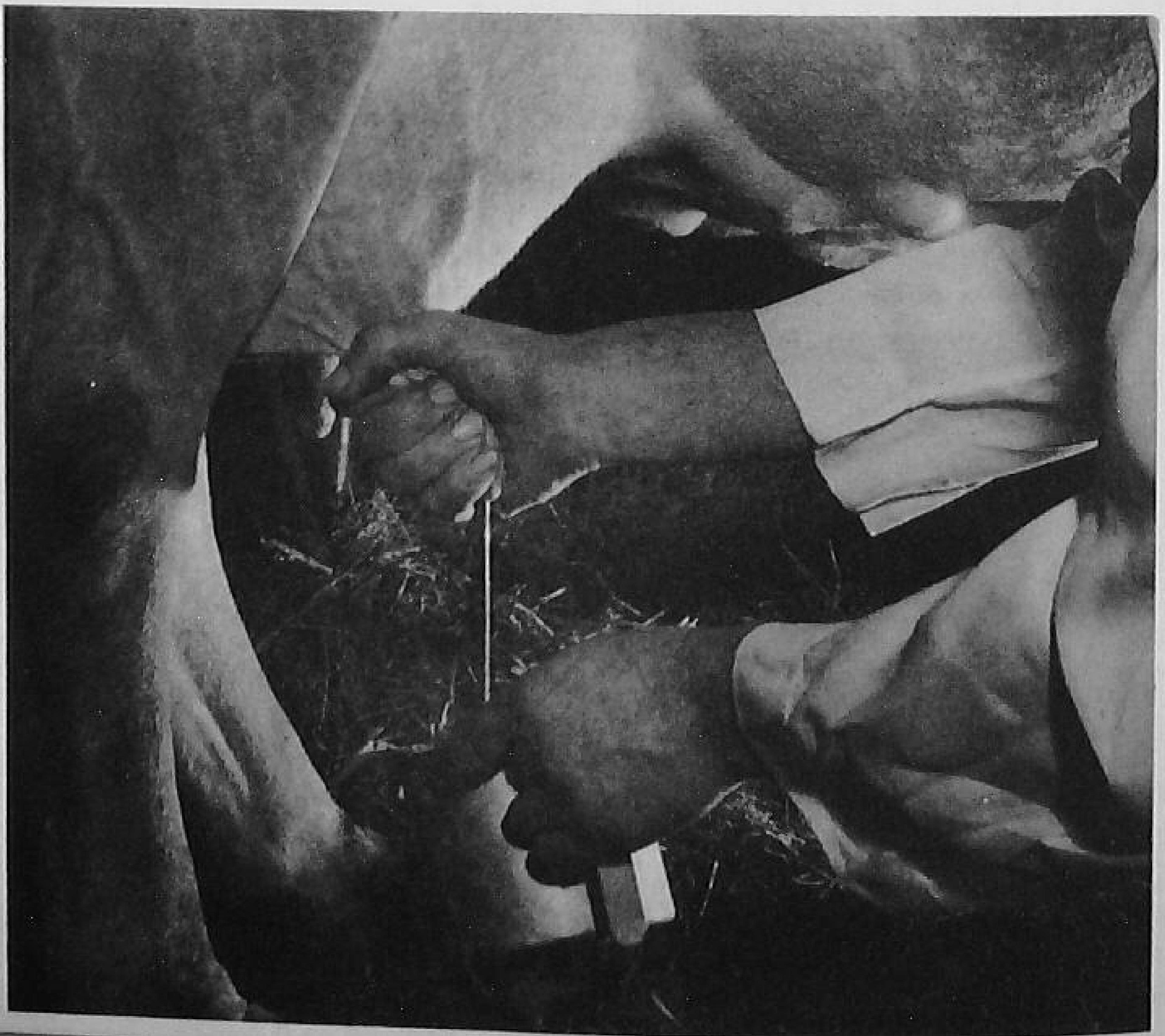
FIGURE 168. *Clipping the underline (left), udder (center), and rear flank (right) is important in keeping the cows clean. (Courtesy Sunbeam Corporation.)*

clean, not only for the production of clean milk but for the health of the animals. The clipping of long hair from the udder, hind legs, and rear flanks will help to prevent accumulations of filth. Brushing the cows daily is a good management practice.

Milking the Cows. The proper milking of cows should be well understood and practiced for best results. When the cow is stimulated by the washing or massaging of the udder, a hormone is released into the bloodstream and reaches the udder in about one minute. This hormone causes a contraction of the muscles surrounding the milk-producing cells, which forces the milk into the teats. If the cow is frightened or made nervous in any way, another hormone is secreted, causing a constriction of the blood vessels which prevents the milk-secreting hormone from entering the bloodstream. The steps necessary for good milking practices are as follows:

1. Wash the udder with warm water and wipe it dry, just before the milker is to be put on.
2. Use a strip cup and draw two or three streams of milk from each quarter. This removes any dirt from the teat canal and gives the operator a chance to see if the milk is normal. If

FIGURE 169. *The use of the strip cup will help to detect udder infection and clean the teat canal. A few streams should be milked from each quarter before applying the milker. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



any abnormality appears, the cow should be milked last and the milk kept separate.

3. Dip the teat cups in a recommended disinfectant before placing them on the cow as a precaution against spreading udder infection from one cow to another.
4. Milk as quickly as possible.
5. Strip the cow by pulling the teat cups downward with one hand and massaging the udder with the other.

HOUSING AND EQUIPMENT FOR DAIRY COWS

The dairy cow requires about 150 man-hours of labor per year. Labor cost is second only to feed cost in dairy cattle expenses. Every effort should be made to reduce labor cost. Housing and equipment should be planned with a view to reducing the time required in caring for the cow. There are two common systems for housing dairy cattle: (1) Stanchion barn and (2) Loose housing.

Stanchion Barn. There are two general types of stanchion barns: (1) the two-story barn, commonly used in the northern regions, and (2) the single-story barn, frequently found in the southern regions and becoming more popular in the North.

The two-story barn. In the two-story barn feed, especially roughage, is stored on the second story. The lower story is used for housing cattle. The advantages of the two-story barn are: (1) It is convenient to work in because all feed may be stored on the second story and moved down by gravity; (2) it provides more cubic feet of storage space in relation to ground area covered by the building.

The single-story barn. With the increased use of baled or chopped hay and silage, the one-story barn has gained in popularity. Less storage room per ton of feed is required when hay is baled or chopped. Silage is not commonly stored in the barn. The weight per cubic foot of baled or chopped hay is so great that considerable bracing and heavy timbers are required in the barn when the roughage is stored in the second story. The advantages of the single-story barn are: (1) less windstorm hazard, (2) reduced fire risk, (3) easier building, and (4) easier repairs.

The stanchion-barn plan. Space will not permit a detailed discussion of the many types of stanchion barns one may decide to build. The agricultural colleges of each state will furnish plans, free or for a small charge, from which one may select a type that

FIGURE 170. *A modern dairy plant.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

will best fit individual conditions. Cows spend a great deal of time in the stanchion when this type of barn is used. They generally feed and, in the more modern type, drink from the stanchion area. It is important that the stanchion area be of a size that will be comfortable for the cattle and easy to clean. Table 33 gives the dimensions of stalls for cows of various sizes measured from rear of stanchion to edge of gutter. Gutters should be constructed to provide for the installation of barn cleaners.

TABLE 33

RECOMMENDED DIMENSIONS OF COW STALLS

Weight of Cow	*Width of Stall*	*Length of Stall*
800	3′ 4″	4′ 6″
1000	3′ 8″	4′ 8″
1200	4′ 0″	5′ 0″
1400	4′ 4″	5′ 4″
1600	4′ 8″	5′ 8″

Insulation and ventilation. Since cows spend much time in the stanchion of the stanchion-type barn, especially in the northern areas, it is important that the building be well-insulated and ventilated. Floors must be easy to clean because the cows are milked, housed, and fed in the same area. The floors should be made of cement or some other easy-to-clean material which is likely to be cold unless the barn is properly insulated. When the cow's udder

FIGURE 171. *Interior of a modern stanchion barn. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

is subjected to cold floors and drafty conditions, there is more danger of udder diseases developing.

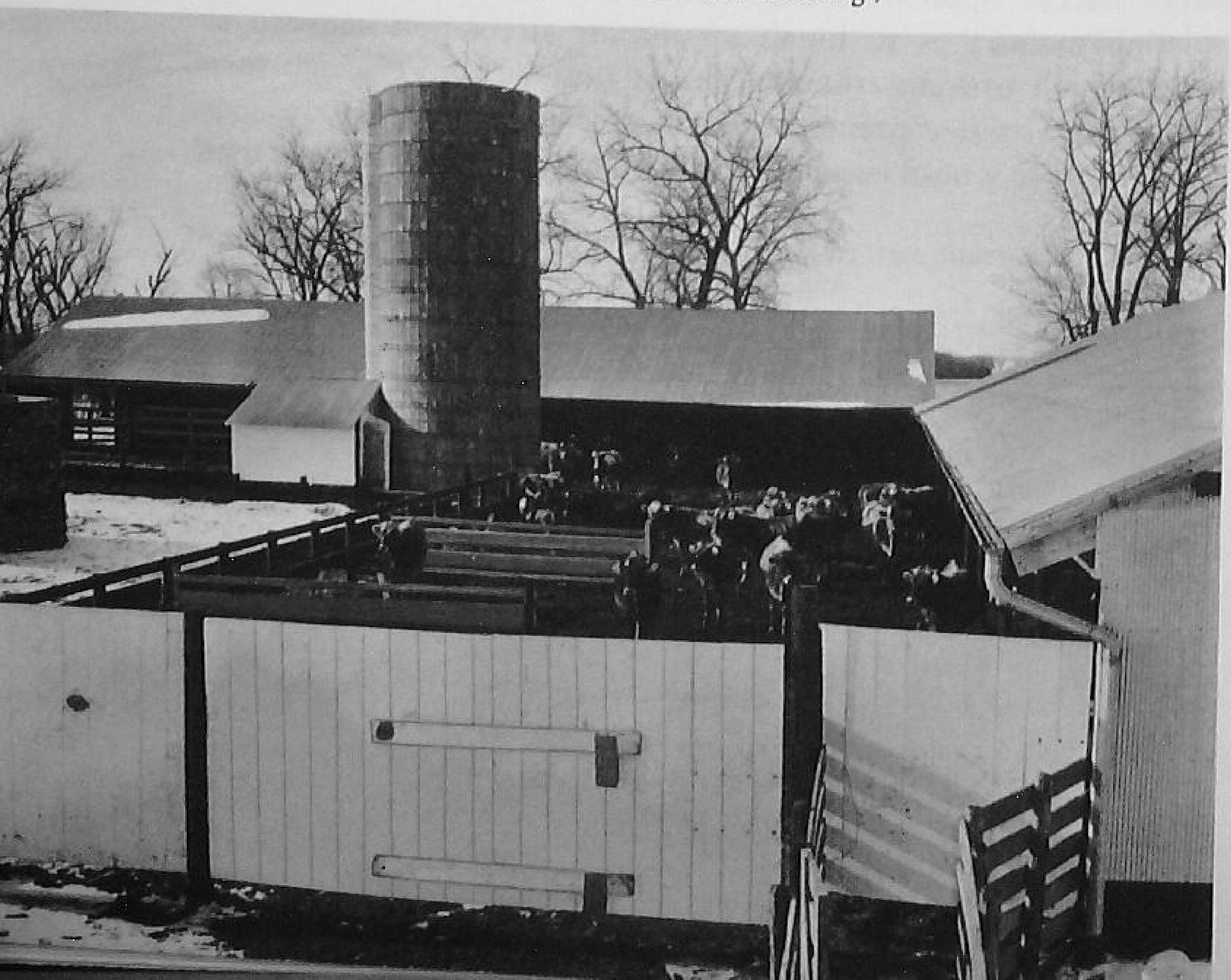
Successful insulation depends upon two principles: (1) a double wall filled with a recommended insulating material, and (2) a vapor barrier applied to the inner wall. The purpose of the insulating material is to break up the air circulation between the walls which prevents the transfer of heat or cold through them. The vapor barrier prevents moisture from penetrating the inner wall where it would condense. There are a number of good com-

FIGURE 172. *Automatic barn cleaner. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

mercial insulating products from which to choose. The vapor barrier may consist of two coats of aluminum paint applied to the inner wall. Waterproof glazed surface paper or other waterproof material that will prevent moisture from penetrating the inside wall may be used. Warm air will hold more moisture than will cold air. When a barn is full of livestock, considerable moisture is picked up by the air as it is warmed from the heat given off by the animals. When the air is cooled, it can no longer hold as much water, and condensation occurs. When the air that circulates inside a building strikes the cold walls and ceiling, the moisture condenses and the walls or ceiling becomes wet. If the walls and ceiling are properly insulated, they remain at about the same temperature as the interior of the building and no condensation takes place.

Ventilation is the controlling of the air movements by the proper installation of intakes and outlets. Cool, dry air from the outside is brought in. As the air warms, it picks up moisture given off by the livestock. The outlets afford a place for the warm, moist air to escape, and the process is repeated. Tight walls and

FIGURE 173. *A loose housing area. The picture shows the feeding, loafing, and paved lot area. The milking parlor is to the upper left. (Pease photo. Reprinted from* Successful Farming.)



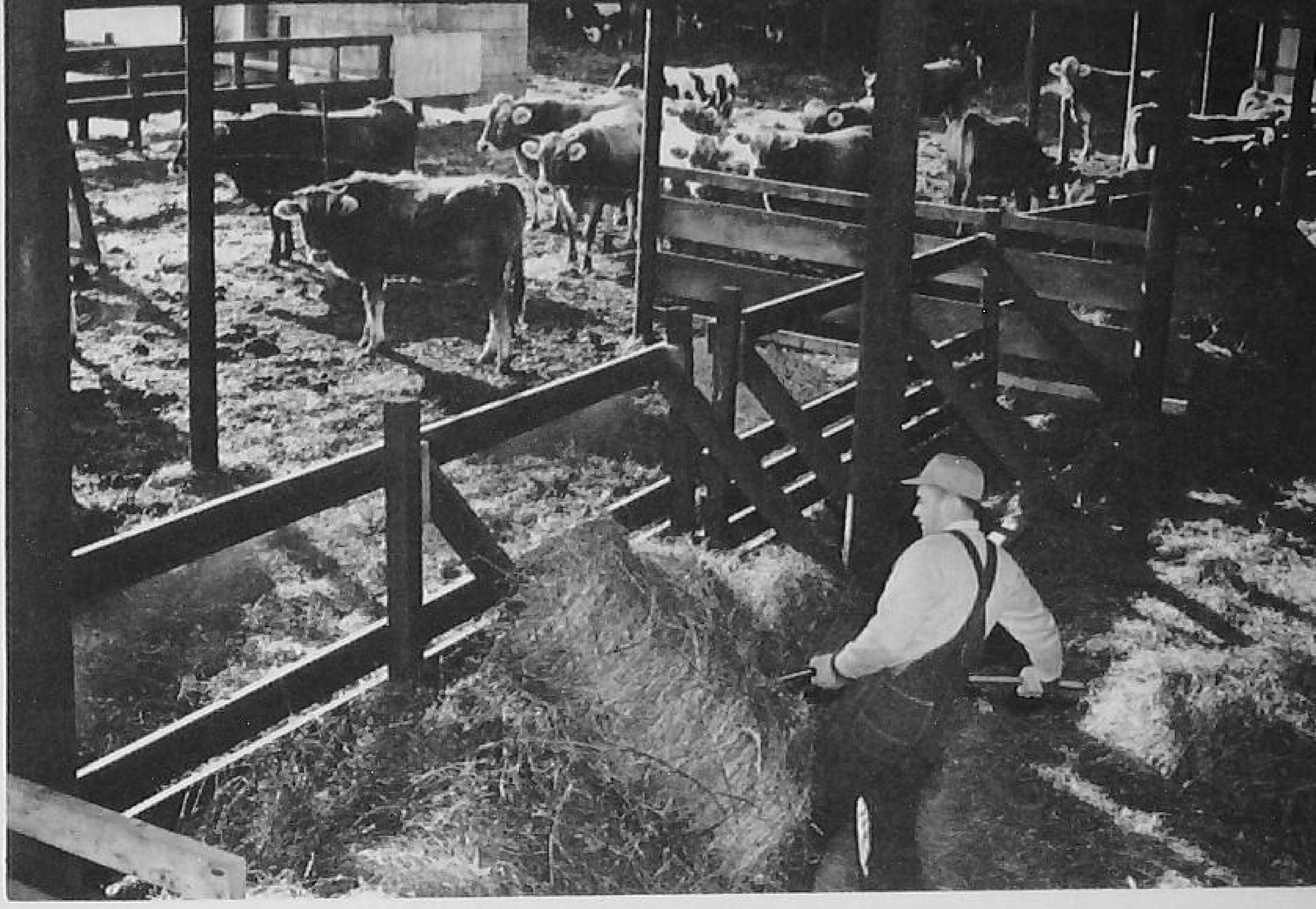


FIGURE 174. *Feeding area of the loose housing system. (Pease photo. Reprinted from* Successful Farming.)

ceiling that permit the control of air circulation are necessary for good ventilation.

Temperature. Cows do not need especially warm barns in order to produce well. A stanchion barn maintained at a temperature of about 50 degrees is sufficiently warm. Sudden changes of temperature will cause a drop in milk production. In a well-insulated barn where ventilation may be controlled, the dairyman can prevent the radical changes in temperature that will occur in a poorly constructed building.

THE LOOSE HOUSING SYSTEM

The loose housing system has been increasing in popularity among dairymen during the last few years. The system provides for a flexible housing arrangement that may be enlarged easily as the herd increases in size. The cows are free and have access to fresh air and sunlight. Ventilating problems are held to a minimum. The loose housing system provides for low-cost housing that may be arranged so as to reduce labor to a minimum.

The loose housing system consists of four units: (1) a feeding and feed storage area, (2) a paved lot, (3) the loafing and bedding storage area, and (4) the milking parlor. The four units may be under the same roof or in separate buildings.

FIGURE 175. *Loafing area of the loose housing system. (Pease photo. Reprinted from* Successful Farming.)

Feeding and Feed Storage Area. The feeding area is where the feed is stored and where the cows are fed their hay. The feed may be stored in the rear of the shed and a movable feed rack constructed. As the cows eat into the hay, the rack is moved, thereby saving the labor of handling the hay. The feeding area should be paved and the manger constructed so as to prevent the cows from pulling out the hay and lying on it.

The Loafing Area. This is the area where the cows rest. The manure pack is allowed to accumulate. The fermentation of the manure creates heat which keeps the cows warm and comfortable. The area needs to be bedded heavily if the cows are to be kept clean. About 12 pounds of bedding will be required per cow per day. At least 60 square feet of space per cow should be provided. The area does not have to be kept especially warm, but drafts should be avoided. The calf pens and calving stalls may be constructed in this area. In building the loafing shed, the need for cleaning with a power loader should be kept in mind. By spring the manure may be from 2 to 4 feet deep and trampled solid.

The Paved Area. Cows make good use of sunshine even in very cold weather if a windbreak is provided. The building may be constructed so as to give protection on the north and west. The paved lot should extend east and south of the buildings. Silage may be fed in bunks on the paved lot.

The Milking Parlor. The milking parlor is where the cows stand in either stanchions or elevated stalls for milking.

The floor level system. This system consists of stanchions for confining a few cows at a time for milking. The operator stands on the same level as the cows. They are usually fed their grain ration while in the stanchion. The cost is low and construction is easy with this type of milking parlor. Usually four stanchions are required for from eight to ten cows.

The elevated stall system. Under this system the cow is 30 inches above the level of the floor on which the operator stands. The self-closing doors may be opened by rope and pulley. One cow is changed at a time because turnover is easy. The operator can do his work with a minimum of stooping, which lessens fatigue.

FEEDING AND MANAGEMENT OF THE DAIRY BULL

The feeding and management of the dairy bull will have considerable effect upon his serviceability in the herd. Dairy bulls do not always have the best dispositions, and many people have lost their lives or have been injured by them. The most gentle bull should never be trusted; proper equipment for handling him is essential.

FIGURE 176. *Elevated stall-type milking parlor.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

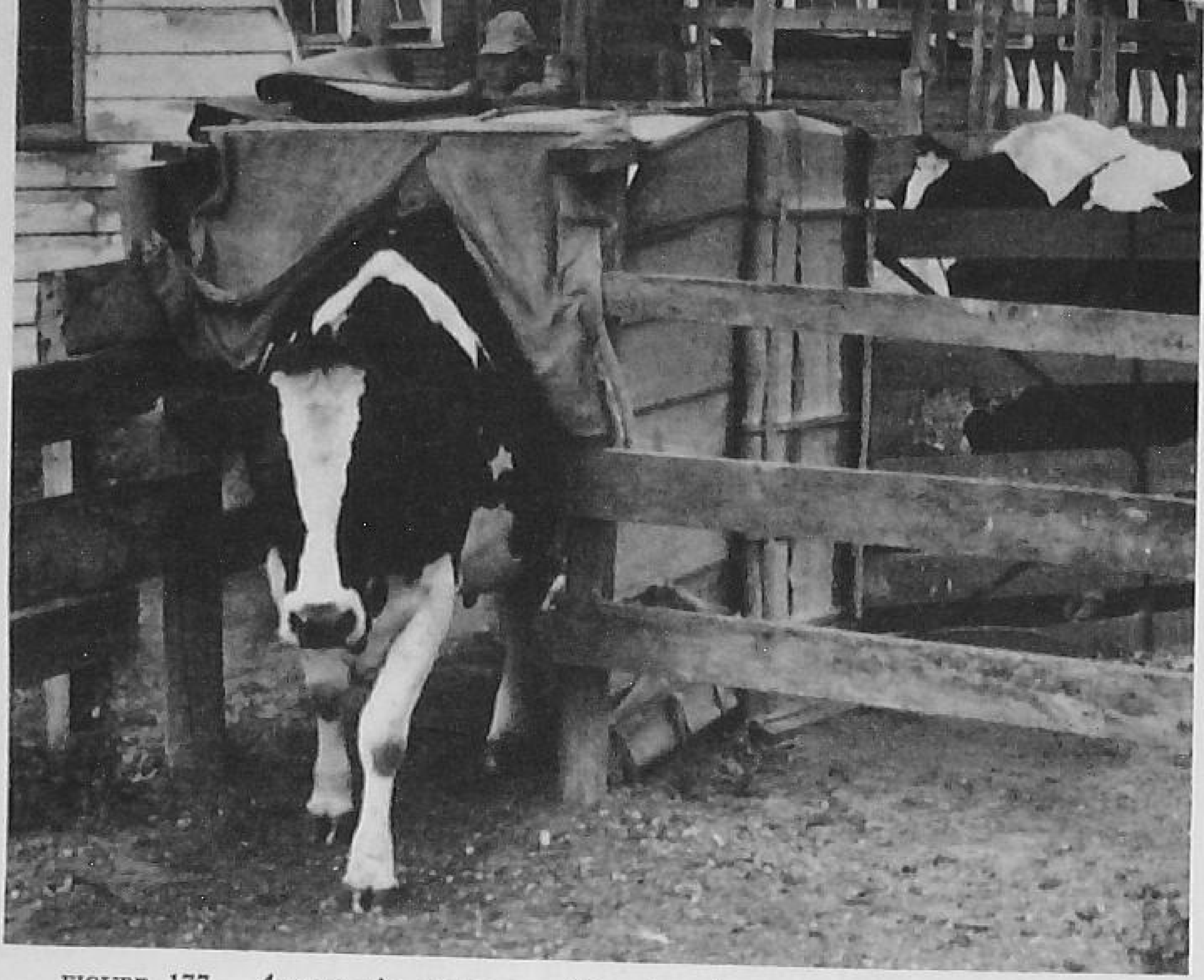


FIGURE 177. *Automatic sprayer.* (*Reprinted from* Successful Farming.)

Feeding the Bull. The dairy bull should be well grown out. He should be fed much the same as the heifer calves and yearlings. (For feeding and management of young stock see Chapter 19.) Like the dairy cows, the bull should get the majority of the digestible nutrients in his ration from good roughage, such as hay or silage. It is not advisable to feed silage as the only roughage in the ration. Experienced dairymen usually limit the silage to about 15 pounds daily. When half or more of the roughage fed is good legume hay, protein concentrates are not necessary. From 4 to 6 pounds of grain should be provided daily. The grain may be oats, barley, corn, sorghum, or a combination of any of these grains.

During the summer some pasture or fresh-cut forage should be provided. There is no proof that fresh green forage is essential, but the bull may need some of these rich vitamin feeds for long service in the herd.

Housing and Yard. The bull should have exercise, but it is never a wise policy to allow the bull to run with the herd. He should have a well-constructed exercise pen and shelter. The pen should be built in such a way that the bull can be fed and cared for with the least possible danger to the operator.

All of the agricultural colleges have plans for bull pens. These plans may be supplied by the vocational agricultural instructor or county agent.

Ringing the Bull. Because bulls are dangerous, they should have rings placed in their noses at an early age. A staff, which is attached to the ring, is used in handling.

Trimming the Feet of the Bull. Since the bull is confined to a small lot, he will not wear down his hoofs. The feet should be trimmed at least once a year.

Age for Service. Well-grown bulls may be used for light service at from ten to twelve months of age. At two years of age bulls reach their maximum breeding powers, which are retained until they are about six years old.

SUMMARY

The dairy cow consumes raw material and turns out a finished product. The automobile factory must have a certain amount of steel, copper, aluminum, and other raw materials to produce its products. Since the specifications for each automobile call for an exact amount of each raw product, no auto can be produced unless there is enough of each material to do the job. Nature is quite exact in the specifications she lays down for the product produced by each cow. Milk will consist of a certain percentage of minerals, vitamins, proteins, fats, water, and so on. Unless the feed consumed by the cow will provide enough of each nutrient to meet nature's specifications for that cow's milk, the cow will be limited in her production. Nature doesn't say, "I have enough nutrients, except protein, for this cow to produce 60 pounds of milk; therefore, the protein content will be reduced." Instead she says, "I have only enough protein for 40 pounds of milk; therefore, that is all that shall be produced."

If a cow is to produce to the maximum of her ability, she must have a balanced ration.

Legumes, silage, and grasses make good roughages for dairy cows. Grain crops and grasses are lower in protein than are legumes. Pastures provide excellent feed at relatively low costs.

Corn, oats, barley, wheat, and sorghum grain are all good dairy feeds. Beet pulp is generally classified as a róughage, but is more nearly like a grain in composition. Wheat bran is successfully used by many dairymen as a partial substitute for grain.

The oil seed meals, corn gluten meal, corn gluten feed, distillers' grains, and soybeans are all good sources of proteins.

Good roughages should be the basis of dairy rations. Grains

and protein concentrates should be fed according to production.

Cows should be dry for at least six weeks. During the dry period they should be fed a ration that will rebuild their bodies for the next lactation period.

Feeds for the cows about to freshen should be bulky and mildly laxative. The amount of concentrates should be reduced a few days before calving. The cows should be brought up to a full concentrate ration slowly over a four weeks' period.

The heifer of the larger breeds may be bred at eighteen months of age.. The smaller breeds may be bred when sixteen to seventeen months old. Fall freshening is generally the best.

Through artificial insemination owners get the services of outstanding bulls at a comparatively low cost.

Cows come in heat on an average of every twenty-one days. The heat period lasts for an average of eighteen hours. The average length of the gestation period is 282 days.

Cows should be clipped around the udder, rear flank, and hind legs for sanitation purposes.

Proper milking consists of washing and massaging the udder, drawing a few streams of milk into a strip cup from each quarter, milking quickly, and stripping properly.

There are two systems of housing—the loose housing system and the stanchion type system. Both systems have advantages and disadvantages. In the stanchion barn the cows are confined a large part of the time in the barn. They are milked, fed, and housed in the same area. There are two kinds of stanchion barns—the two-story and the single-story type. The loose housing system consists of a loafing area, a feed area, a paved lot, and a milk parlor.

The dairy bull should be placed in a substantial pen where he can get adequate exercise and will not endanger the lives of any persons. His ration should consist of good roughage full-fed and from 4 to 6 pounds of grain daily. He should have a ring placed in his nose. When it is necessary to handle him, a staff should be used. The feet need to be trimmed about once a year. The young bull may be used to breed a few cows when from ten to twelve months old.

QUESTIONS

1. How would you rank, according to their food value, the various roughages used for dairy cattle?

2. List the common grain concentrates fed dairy cows.
3. List the common protein concentrates used for dairy cow feed.
4. Why are pastures so important to the dairyman?
5. How does the dairy cow use her feed?
6. Explain why the good producer is so much more profitable than the poor producer.
7. Why are roughages the basis of dairy rations?
8. How much milk can a cow produce on roughages alone?
9. How should the kind and amount of concentrates to be fed be determined?
10. List some good concentrate mixtures for dairy cows that may be fed with various kinds of roughages.
11. Give a good rule for feeding concentrates with cured roughages and one for cows on pasture.
12. Explain the procedure used in drying-off cows.
13. How should the dry cow be fed?
14. How would you recommend feeding the cow just before calving?
15. Explain the system for feeding the fresh cow until she is on a full feed of concentrates.
16. Why is it unwise to milk a cow dry shortly after freshening?
17. What governs the time dairy heifers may be bred the first time?
18. At what time of year is it generally best to have cows freshen? Why?
19. What is artificial insemination, and what are its advantages and disadvantages?
20. How can you help to insure good results from artificial insemination?
21. How often does the average cow come in heat, and how long does she stay in heat?
22. What is the average length of the gestation period for cows?
23. How should cows be prepared for milking?
24. Give the rules for proper milking.
25. Explain the two common systems of housing dairy cows.
26. What are the advantages of each housing system?
27. Give a good ration for the dairy bull.
28. Explain the safety measures that should be practiced in handling the bull.

REFERENCES

Blackman, C. L., *Feeding Dairy Cattle*, Ohio State University, Columbus, Ohio, Extension Bulletin 72.

Dairy Cattle Housing Sub-Committee, *Dairy Cattle Housing*, Uni-

versity of Wisconsin, Madison, Wisconsin, Agricultural Experiment Station Bulletin 470.

Johnson, Floyd, Porter, Arthur R., and Jackson, Lyle W., *Feeding Dairy Cows*, Iowa State College, Ames, Iowa, Agricultural Experiment and Extension Bulletin P89 Reprint.

Nibler, C. W., *Dairy Herd Management*, University of Nebraska, Lincoln, Nebraska, Extension Bulletin E. C. 631.

Petersen, W. E., *Dairy Science*, J. B. Lippincott, Philadelphia, 1950.

< 19 >

Feeding and Management of Young Dairy Stock

Several agricultural experiment stations have kept records on the death losses of dairy calves for the first four to six months after birth. The records show the death loss to range from 13 to 17 per cent of live calves during the first four months after birth. Calf losses present an important economic problem for dairymen. Most losses of young dairy calves are the result of pneumonia, calf scours, and navel infections. Proper management will eliminate a large percentage of calf deaths due to these ailments.

The first step in the production of calves is to have a strong calf at birth. Weak calves are much more difficult to raise than are strong, healthy calves. To insure strong calves the cows should have at least a six weeks' rest period between lactations, and a well-balanced ration.

ATTENTION AT CALVING TIME

Proper attention given to the cow at calving time will help to insure a live, strong calf at birth.

The Maternity Pen. A few days before a cow is due to calve, a stall should be cleaned, disinfected, and well bedded. Manure and filth should be cleaned off the cow, and she should be placed in the pen. There should be adequate light—dark, damp pens are invitations to trouble. A 10 x 12 foot pen, free from drafts, is desirable. The cow should be observed closely to make sure the calf is in the proper position for birth. The forelegs should be extended and the head between or resting on them. If the cow does not give birth to her calf within a reasonable time, a veterinarian should be called.

Care of the Calf. When the calf is born, the mucus and phlegm

FIGURE 178. *An observation pen, where newborn calves may be kept separate from the rest of the calves, will reduce the spread of communicable diseases.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

should be cleaned from the nose and mouth. If the calf does not start to breathe, it should be held by the rear legs and lifted from the floor with head down. This procedure is a form of artificial respiration and will often produce results if repeated several times. Alternate compression and relaxation of the chest will often start the calf breathing when other methods fail.

As soon as the calf is breathing properly, the navel should be disinfected. Squeezing out the navel cord and painting the navel with iodine will help to avoid infection. If the cow does not lick her calf dry, the dairyman should wipe the calf to hasten drying.

The next step is to remove all cleanings and wet bedding from the pen and to wash the cow's udder with a chlorine solution to prevent any infectious organisms from being taken in through the calf's mouth during the first feeding. If the calf is normal, it will stand and suck within thirty minutes. If it fails to do so, it should be given assistance in getting a feeding of the first or colostrum milk. The colostrum or first milk secreted by the cow is nature's especially prepared food designed to start the calf's digestive system operating. Colostrum should always be fed directly from the

cow for the first two or three feedings at least, without any chance for contamination.

Within two hours after the calf has had its first feed, its bowels should move to eliminate the material accumulated in the digestive tract before it was born. If this does not pass in due time, an enema consisting of a one-half teaspoonful of soda in a quart of warm water should be given.

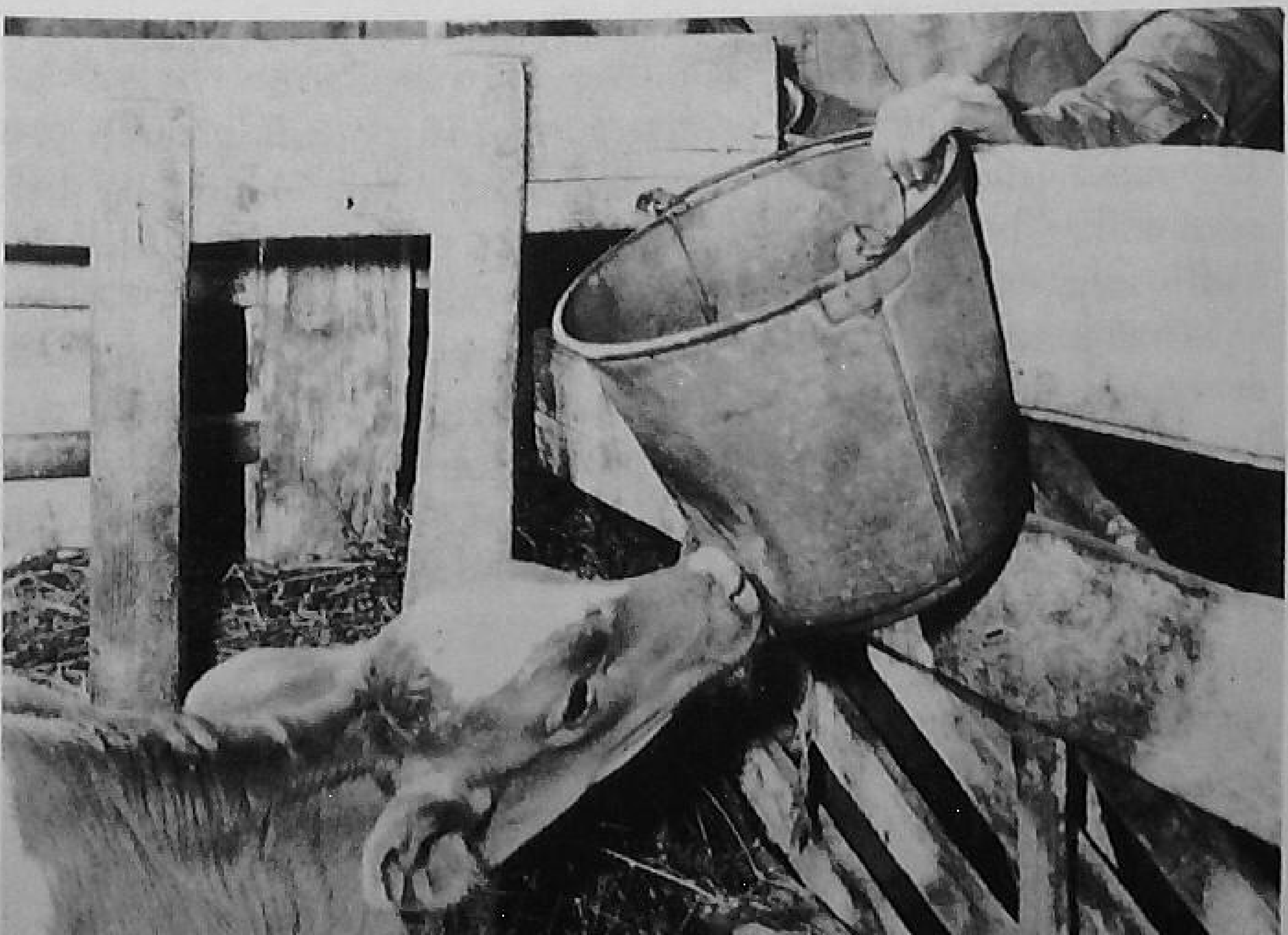
First Three Days After Birth. The calf should be left with the cow for three days and allowed to nurse at will. This insures a full feed of the colostrum and helps to get the calf started in a healthy condition. The cow may give more colostrum than the calf will take. If that is so, partial milking to relieve the pressure in the udder is advisable. Extra colostrum may be fed to older calves that have been weaned. Milking the cow twice a day on all four quarters will give the dairyman a chance to detect any quarter the calf may have neglected.

FEEDING THE CALF FROM FOUR DAYS TO SIX MONTHS OF AGE

When the calf is three days old, it may be separated from the cow and hand-fed liberally on milk, or on limited milk plus a milk substitute, or on a nurse cow.

Liberal Milk Feeding. Maximum growth can be obtained when the calf is fed liberally on milk. The common procedure is to

FIGURE 179. *The nipple pail makes calf feeding easier and reduces calf scours. (Courtesy* Wallaces' Farmer and Iowa Homestead.)



feed whole milk at the rate of one pound for each 10 pounds of body weight for the first month, then gradually switch to skim milk feeding (the same amount in proportion to body weight) until the calf is getting from 14 to 18 pounds of milk. No more than this amount should be fed. It is important that the calves are not overfed on milk. The milk should be fed at from 90° to 100° F. Clean pails should be used. If scouring is observed, the amount of milk should be reduced. The nipple pail has several advantages, the most important of which is that the calves are prevented from eating too fast and less digestive upsets result.

Limited Milk Feeding Plus a Milk Substitute. On farms where whole milk is sold and there is no skim milk available, the use of milk substitutes is common. Whole milk is costly and is not economical to feed beyond the first two to three weeks. Dried skim milk mixed with water at the rate of one pound of powder to 9 pounds of water will give good results if the change from whole to powdered skim milk is made gradually over a ten-day period. Dried buttermilk may be used instead of skim milk. Whey may be fed instead of skim milk, if proper supplements are used. In the manufacture of cheese the protein is taken out of the milk; therefore, whey is low in protein and the protein content of the concentrates ration must be increased.

Calf meals are usually intended as milk substitutes. Although they are not equal to milk, they may successfully replace part of the milk in the calf's ration. Good starters contain vitamins A and D, plus complete minerals. They should be at least 20 per cent protein and not more than 5 per cent fiber. A good home-mixed meal containing the following ingredients may be successfully fed: 100 pounds of yellow corn, 150 pounds ground oats, 25 pounds wheat bran, 50 pounds linseed meal, 75 pounds dried skim milk, 6 pounds steamed bone meal, 6 pounds mineralized salt, and 8 level tablespoonfuls of irradiated yeast.

When a calf starter is used, the calves should be fed whole milk at the rate of one pound for each 10 pounds of body weight during the first three weeks. Starting the fourth week, ½ pound of calf meal should be fed but the milk should not be increased. The milk should be reduced by 2 pounds during the fifth week and the calf starter increased to one pound. During the sixth week the milk should be reduced another 2 pounds and the calf fed all the starter it will eat. When the calf is seven weeks old, milk feeding

should be stopped and the calf given free access to the starter up to 5 pounds. When the 5-pound level has been reached, a less expensive feed may be substituted. If a commercial starter is used, the manufacturer's recommendations should be followed.

The Nurse Cow Method. Calves that are to be grown out rapidly, such as veal calves or purebred animals intended for sale, may be put on a nurse cow. This method is more expensive but reduces the danger of digestive disturbances. Sometimes two or even three calves are placed on one cow. The usual practice is to turn the cow and calves together morning and evening so that the calves may nurse.

Grain Feeding. Regardless of the plan followed for feeding the young calves, they should be induced to eat grain as soon as possible. At first calves prefer whole grains. A mixture of corn and oats fed free-choice for the first five weeks is satisfactory; starting the sixth week, a concentrate mixture is recommended. The kind of concentrate mixture will depend upon the kind and quality of roughage. Some recommended rations with good legume roughage and the lower quality of roughage that may be fed to growing calves follow:

Good Legume Roughage

A. 40 pounds ground shelled corn
   40 pounds ground oats
   20 pounds wheat bran
   1 pound iodized salt
   1 pound steamed bone meal

B. 20 pounds ground shelled corn
   20 pounds ground barley
   20 pounds ground sorghum grain
   20 pounds ground oats
   1 pound iodized salt

Low-quality Roughage

A. 30 pounds ground shelled corn
   30 pounds ground oats
   20 pounds wheat bran
   20 pounds linseed or soybean meal
   1 pound iodized salt
   1½ pounds steamed bone meal
   2 ounces irradiated yeast

B. 30 pounds ground barley
   30 pounds ground sorghum grain
   20 pounds wheat bran
   1 pound iodized salt
   1½ pounds steamed bone meal
   2 ounces irradiated yeast

Rules for Feeding Concentrate to Calves. After the fifth week the concentrate mixture should be fed according to the weight of the growing calf. When good-quality roughage is fed, the concentrates are generally increased until the calf reaches a weight of between 300 and 400 pounds. Since the calf consumes a greater quantity of roughages as it becomes larger, less grain is required. For heifer calves the concentrates are again increased about two months before freshening. When low-quality roughages are used, the concentrates must be depended upon to furnish a larger per-

centage of the digestible nutrients required by the growing calf. The amount should be increased with each additional 100 pounds of weight. Table 34 will serve as a guide in determining the amount of concentrate mixture to feed.

TABLE 34

GUIDE FOR FEEDING CONCENTRATES TO DAIRY CALVES AND HEIFERS

Weight of Animals (lbs.)	*Concentrates Daily (lbs.) With Legume Roughage*	*Concentrates Daily (lbs.) With Low-Quality Roughage*
100	Free Choice	Free Choice
200	4	5
300	5	5
400	4	5½
500	3	6
600	2	6
2 to 3 months before freshening	5	7

Feeding Roughages to Calves. Calves will start to eat hay at about ten days of age. Choice green, leafy legume-grass mixed hay is best. The hay should be kept fresh by removing any left over from the rack and replacing it with new hay each day. Silage is good feed for calves after they reach the age of four months. Calves like silage but should be limited to 2 pounds daily per 100 pounds of body weight.

Pasture. Pasture may replace most of the roughage after calves are six months of age. Under six months of age the calf does not have the capacity to secure the needed nutrients from pasture alone. Until they are six months old calves will do as well in a dry lot as they will on pasture. For maximum growth some grain should be fed when calves are turned on pasture.

Vitamins. Vitamins will usually be supplied in sufficient amounts when milk is fed liberally. With milk substitutes or skim milk and poor roughage, a vitamin deficiency may occur. Vitamin A and niacin are most likely to be deficient. The digestive processes of the newborn calf are similar to those of simple-stomach animals. The rumen does not start to function for several days. Many dairymen add some fish liver oil to the milk as a source of vitamins A and D. A special vitamin concentrate may be purchased which will provide the necessary vitamins until the rumen begins to function and until roughage and concentrates are added to the ration.

Antibiotics in Dairy Calf Rations. Recent experiments indicate

that aureomycin will increase the growth rate of dairy heifers without any apparent effect upon reproduction or milk production. Aureomycin fed in the milk at the rate of 80 milligrams aureomycin hydrochloride per calf per day from 4 to 116 days of age produced the following results:

1. Increased the growth gain from 10 to 30 per cent.
2. Improved the appetite.
3. Decreased the number of cases of calf scours.
4. Increased the efficiency of feed utilization.
5. Produced smoother hair coats.

Other studies have shown that calves that were fed aureomycin until they were 16 weeks of age and were continued on aureomycin up to 28 weeks of age gained 2 pounds per day as compared to a gain of 1.7 pounds per day for those not receiving the antibiotic. Calves will apparently continue to benefit from aureomycin after rumination has started.

Water. Fresh clean water is important for proper growth and development of the calves. Water should be available to them at all times.

GOOD MANAGEMENT PRACTICES

Pens. Young calves need protection from cold weather. Clean, dry, well-ventilated, and well-lighted pens should be available.

FIGURE 180. *Clean, dry, well-ventilated calf pens are essential in reducing calf losses. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

Stanchions along one side of the pen make feeding easier because the calves may be fed and held in the stanchion to prevent them from sucking each other until all have been fed. A dry lot adjoining the pen will permit calves to get sunshine and exercise during good weather.

Dehorning. Calves should be dehorned between one and two weeks of age. (For methods see Beef Cattle, Chapter 13.)

Removal of Extra Teats. Dairy heifers often have extra teats in addition to the normal ones. These extra teats should be removed when the calf is between one and two months old. The best method for removing extra teats is to disinfect the area around the teat and clip it off with a pair of scissors. Usually it will bleed very little. If bleeding is considerable, holding a cotton pack over the wound for a few minutes will stop the bleeding.

Marking. All calves should be marked for identification. This may be done by ear-tagging, ear-notching, tattooing the inside of the ear, or by taking photographs. Holsteins may be easily identified by photographs because the black and white markings are distinctive and different for each animal. For other breeds tattooing, ear-tagging, or ear-notching will probably be more satisfactory.

SUMMARY

The death losses of dairy calves range from 13 to 17 per cent of live calves born. Proper feeding and management can materially reduce these losses.

Cows should be properly fed before calving to insure strong calves at birth. At calving time the cow should be placed in a stall, at least 10 x 12 feet, that is well lighted, well ventilated, reasonably warm, and free from drafts.

When the calf is born, the mucus should be cleaned from its nose and mouth. If the cow fails to lick it dry, rubbing with a sack or cloth will stimulate circulation and help dry the calf. To prevent any infections it is wise to disinfect the navel of the calf and wash the udder of the cow.

Calves may be fed liberally on milk or on limited milk plus a milk substitute, or on a nurse cow. The amount of milk available and the main objectives of the dairyman are the determining factors in the selection of the method to follow.

Calves should be fed milk according to their weight. Grain feeding should be started as soon as the calf will eat. A well-

balanced concentrate ration is important. Good legume-grass mixed hay is the most desirable form of roughage.

Vitamins are important. Usually sufficient vitamins will be supplied by the milk. A vitamin concentrate added to the milk will help to prevent a deficiency.

Antibiotics have aided growth without any apparent harmful effects upon reproduction or milk production.

Dehorning, clipping extra teats, and marking should be done at an early age.

QUESTIONS

1. What are some of the management practices that will reduce calf losses?
2. Give the three methods of feeding calves.
3. Under what conditions would each of the three calf-feeding methods be advisable?
4. What is the rule for feeding milk to calves?
5. List some good concentrate mixtures that will fit both good and poor roughage.
6. Why is good roughage important in feeding dairy calves?
7. What effect have antibiotics had on dairy-calf growth?
8. What are the important considerations in providing calf pens?
9. When should calves be dehorned?
10. How should the extra teats be removed? When is a good time to do this job?
11. What are some of the methods that may be used for calf identification?

REFERENCES

Davis, H. P., *Dairy Calf Births and Disposals*, University of Nebraska, Lincoln, Nebraska, Agricultural Experiment Station Bulletin 411.

Murley, Ray, Jacobson, Norman L., and Herrick, John B., *Raising Dairy Calves*, Iowa State College, Ames, Iowa, Agricultural Experiment Station, Agricultural Extension Service Bulletin P 106.

Rupel, I. W., and Werner, George, *Better Dairy Calves*, University of Wisconsin, Madison, Wisconsin, Extension Bulletin 359.

Weaver, Earl, Johnson, L. A., and Smiley, E. S., *Raising Dairy Calves*, Michigan State College, East Lansing, Michigan, Extension Bulletin 105.

< 20 >

Marketing Dairy Products

The profit from dairy production is determined by the economy of production and by the selling price. Feed makes up about 50 per cent of the cost of production; labor makes up about 33 per cent. Efficient production practices alone, however, will not insure a profitable enterprise. The dairy products produced must be of such quality and produced at such a time that the consumer market will absorb the products at a reasonably high price. The form in which the products are sold also may affect the net income from the enterprise. Milk may be sold as Grade A, Grade B, Grade C, or as ungraded milk. The milk may be separated on the farm, with the butterfat being sold and the skim milk being used on the farm as feed.

A farmer can increase the income from the dairy enterprise through improved marketing practices by: (1) planning production so that large quantities of milk or butterfat can be marketed during the seasons of high prices; (2) selecting the form in which to sell the products that will yield the largest net return; and (3) improving the quality of the products he has to sell.

SEASONAL PRICE TRENDS

Milk Prices. A common practice on many farms is to have the cows freshen in the spring so that they make maximum use of pastures. This system minimizes the need for feed, labor, and housing during the winter months, but it encourages heavy production of milk and butterfat in the spring and early summer. Since a large share of the dairy cows in this nation have been kept by farmers with small herds, we have had heavy production of milk in the spring and light production during the winter months. As a result the price of milk is low in April, May, and June, and high in November, December, and January.

FIGURE 181. *Monthly milk prices per cwt. U.S. average, 1943–1952. (U.S.D.A.)*

Usually about 40 per cent of a cow's production takes place in the first four months after calving. It is a good idea to breed the cows so that 40 per cent of the total production can be sold during the months of high prices. As shown in Figure 181, milk sold in May during the 1943–1952 period sold for an average of $3.65 per hundredweight, whereas milk sold in November and December for an average of $4.37. The difference in the selling price of the milk produced in one month by a herd of ten cows producing an average of 40 pounds per day would amount to $86.40. The difference in selling price was $.72 per hundredweight.

Figure 182 shows the average monthly price of milk in the United States prior to World War II. Note that the difference between the price of milk in June and in December averaged $.24 per hundredweight.

Butter Prices. A number of factors have affected the price of butter since 1940. The competition of oleomargarine has lowered the demand for, and the price of, butter; the governmental price stabilization programs have also influenced butter prices.

Figure 183 shows butter prices in January and February in Iowa during the 1948–1952 period to be about $.06 higher than in October and November, and about $.04 higher than the prices in June and July.

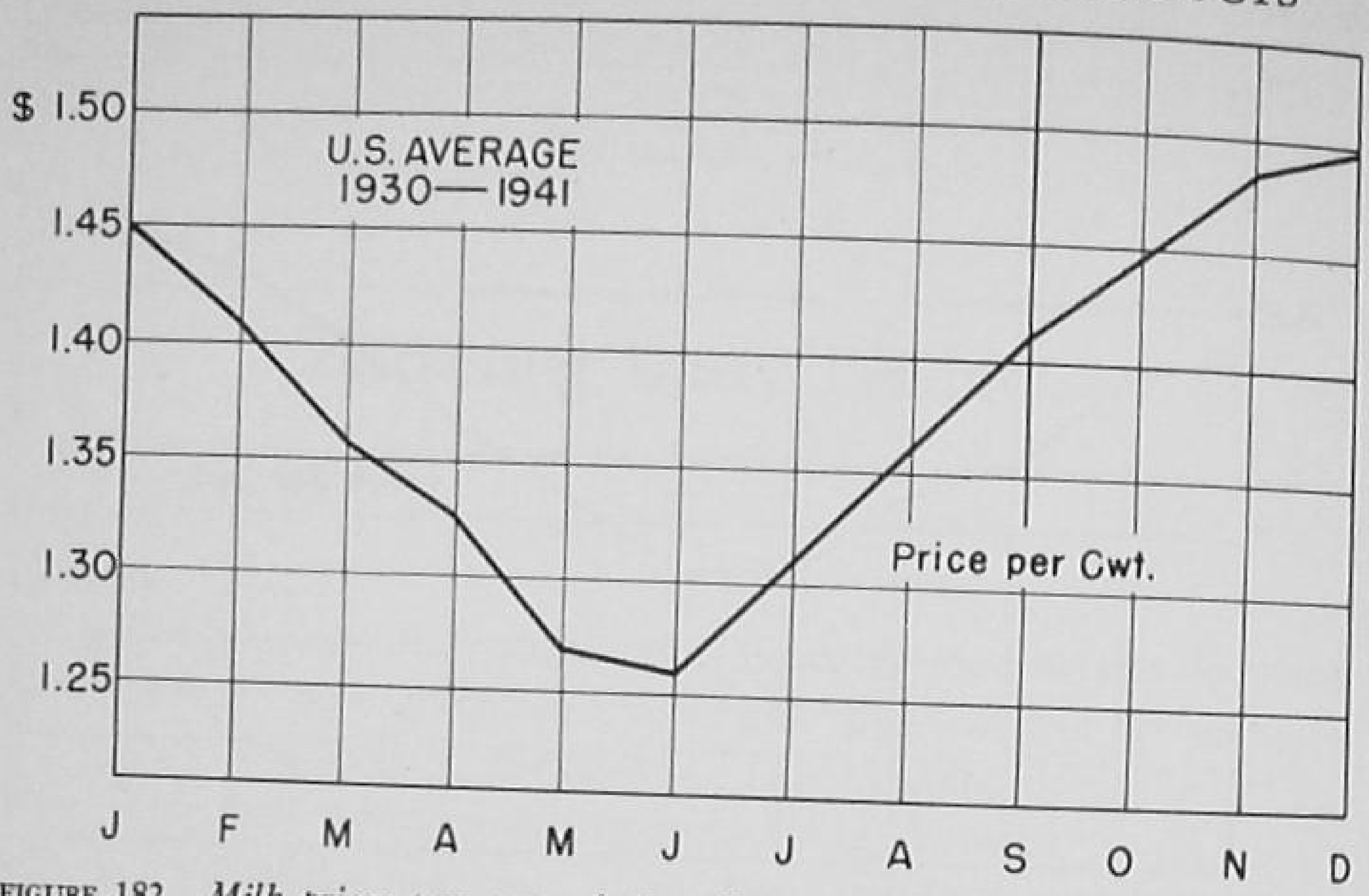


FIGURE 182. *Milk prices per cwt. whole milk to condensaries. (U.S.D.A. Bureau of Agricultural Economics.)*

Butterfat Feed Price Ratios. Another method of determining the best time to produce and sell butter is to compare the butterfat feed price ratios. (Feed price ratios refer to the number of pounds of feed a pound of butterfat will pay for.)

According to information in Table 35 the highest ratios during the 1937–1941 period were during October, November, and December.

TABLE 35

BUTTERFAT FEED PRICE RATIOS, UNITED STATES BY MONTHS *

Month	*1937–1941*	*1943–1947*
January	24.2	26.8
February	23.2	26.1
March	22.6	26.1
April	21.6	26.0
May	21.4	23.8
June	21.7	23.2
July	22.9	23.2
August	24.2	26.3
September	24.6	24.7
October	26.5	25.9
November	27.3	25.8
December	27.6	26.2

* Research and Analysis Division, PMA.

The highest ratios during the 1943–1947 period were during December, January, February, and March. The low ratios

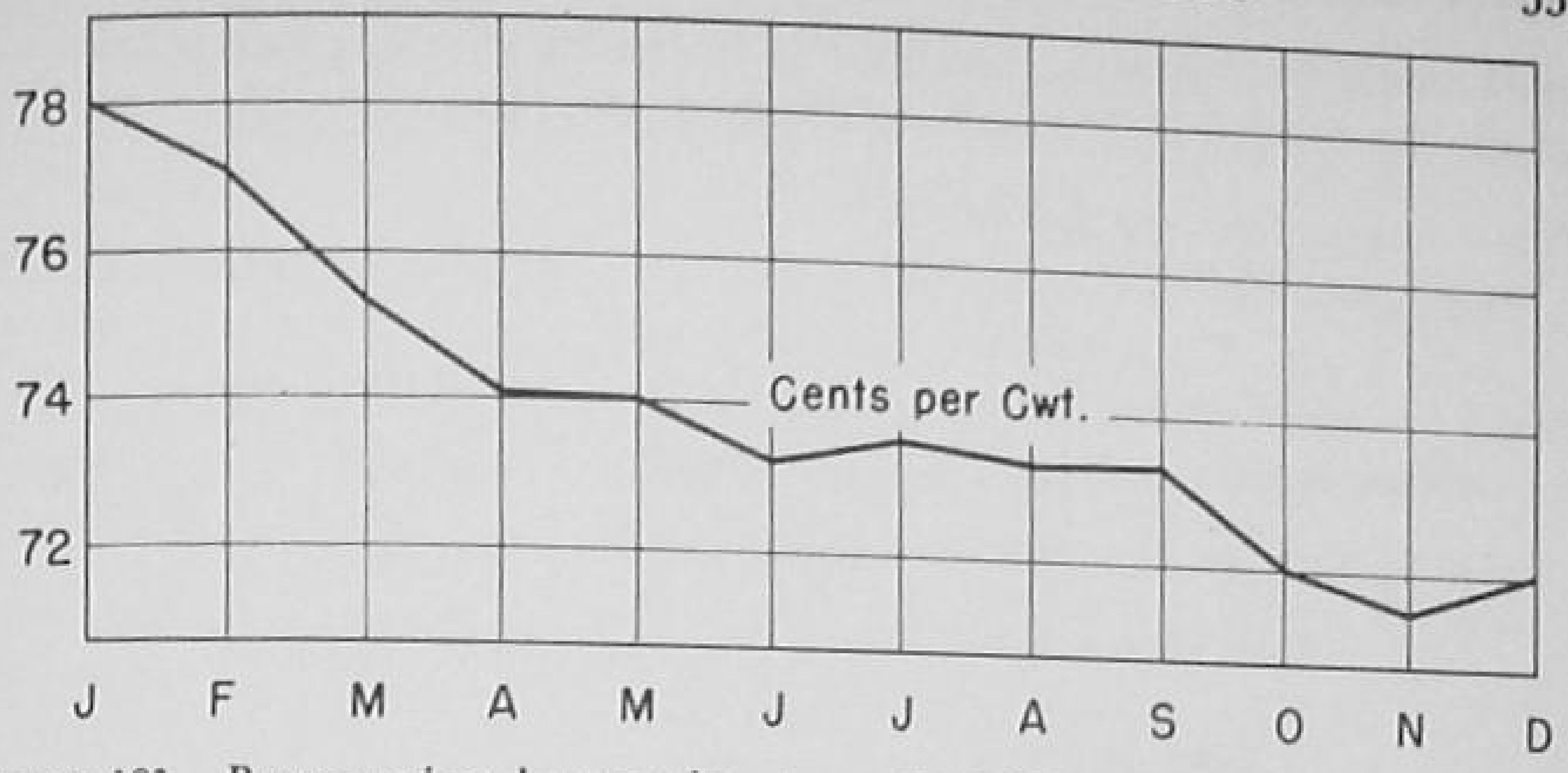


FIGURE 183. *Butter prices by months. Iowa, 1948–1952 average. (Iowa Crop and Livestock Reporting Service.)*

during both periods were during the late spring and summer months. This information indicated the advisability of planning the heaviest butter production for the late fall and winter months.

FORM IN WHICH MILK SHOULD BE SOLD

The method of disposing of milk varies with the area of the country and from community to community. In 1950, nearly 84 per cent of the milk produced in the Atlantic States and 80 per cent of the milk produced in the East North Central States was sold as fluid milk. About 50 per cent of the milk produced in the West North Central States was sold as cream to be used in butter-making.

Each dairyman must make a careful analysis of the market available in his community and calculate the probable income from the use of various marketing programs. At one time skim milk was indispensable as a feed for calves, chickens, and pigs. We now have feeds which will take its place, and farmers are more willing to sell whole milk than they were twenty years ago.

The following is an example of the calculations made by one dairyman to determine the best method of disposing of the milk produced by his herd.

Example

The herd consisted of eighteen cows, which produced during the previous year an average of 341 pounds of butterfat and 9220 pounds of milk. The milk could be sold as Grade A milk for $4.40 per hundredweight. It had an average butterfat test of 3.7 per cent. The

milk could be separated and sold as butterfat for $.74 per pound. A truck would pick up the milk or cream at the farm.

Plan 1 Income from the Sale of Milk:

165,960 pounds of milk (9220 X 18) at $4.40 per cwt.	$7302.24

Plan 2 Income from the Sale of Butterfat and Use of Skim Milk as Feed:

6138 pounds of butterfat @ $.74 per pound	$4542.12
159,822 pounds of skim milk @ $.40 per cwt. (to be used as feed)	639.29
Total income	$5181.41
Difference in income in favor of Plan 1	$2120.83

Under Plan 1 it would be necessary for the dairyman to provide the sanitary quarters, milk room, and milk-cooling facilities required in producing Grade A milk.

These conditions are desired under Plan 2 but are not required. A separator and cooling tank for cream must be provided. Pigs, calves, or chickens must be available to consume the skim milk.

The example presented points out the following important considerations which must be made in deciding the form in which milk should be sold:

1. The value of the butterfat produced must be compared with the value of the Grade A milk.
2. The use and value of the skim milk must be determined.
3. An estimate must be made of the increase in cost necessary to produce Grade A milk.
4. A study must be made of the availability, cost, and dependability of transportation to market.

In the case presented, the butterfat price was low in comparison to the price of Grade A milk, and the skim milk value for feed purposes was under its value on the commercial market for drying or condensary purposes.

MARKETS AVAILABLE

The number and types of markets available in a given area are determined by the density of population in the area, the quantity of milk produced, and the cost of transporting the dairy products to market. Table 36 shows a summary of the milk-processing plants in the United States in 1950.

TABLE 36

Milk Processing Plants in the United States—1950 *
(Number of Plants)

Region	*Butter*	*Ice Cream*	*Cheese*	*Evaporated Milk*
New England and Middle Atlantic...	244	783	214	5
North Central	2172	1250	1676	71
South Atlantic and South Central....	264	741	123	21
Mountain and Pacific	379	497	146	25
Total	4059	3271	2159	122

* U.S.D.A.

IMPROVING THE QUALITY OF DAIRY PRODUCTS

The quality of milk and cream to be used for pasteurization and bottling, and for butter production, has been given considerable attention by city health authorities and by milk processors. Most cities have ordinances that stipulate the quality of milk which may be sold, and the conditions under which it must be produced. Most ordinances are based upon Grade A milk standards recommended by the United States Department of Health, Education, and Welfare.

Milk retailers have found that increased quality stimulates consumption and that consumers are willing to pay higher prices for milk of high quality. As a result the demand for milk of superior quality is such that milk processors and dairies are paying the producers premium prices for high-quality milk. In some cases the premium amounts to as much as $1.00 per hundredweight. The added income from the sale of high-quality milk from a herd of ten cows producing an average of 9000 pounds of milk may range from $200 to $300 to nearly $1000 per year.

Most creameries pay several cents more per pound for butterfat in sweet cream of superior quality than for butterfat in sour cream of poor quality. Sweet cream butter sells better on the consumer market and can compete with butter substitutes. Poor-quality butter is frowned upon by most housewives. It pays to produce high-quality milk and cream.

GRADE A MILK

Definition. According to the U. S. Public Health Service Ordinance, Grade A raw milk for pasteurization is raw milk from producer dairies conforming to certain standards of sanitation. The

bacterial plate count, or the miscroscopic clump count of the milk, as it is delivered from the farm, shall not exceed 200,000 bacteria per milliliter. (A milliliter is approximately one-thousandth of a gallon.) The ordinance provides for the inspection of the cow herd, the milking barn, the milk house, the utensils and equipment, and the milking of the cows by an authorized public health officer.

Requirements. *Healthy cows.* Since disease may spread through the cows to humans and to other animals, the herd must be accredited or tested for tuberculosis at least once every six years, according to the modified accredited area plan of the U.S.D.A. The herd must also be certified as free from Bang's disease, according to procedures approved by the U.S.D.A. Bloody, stringy, and other abnormal milk produced by cows with mastitis must be excluded

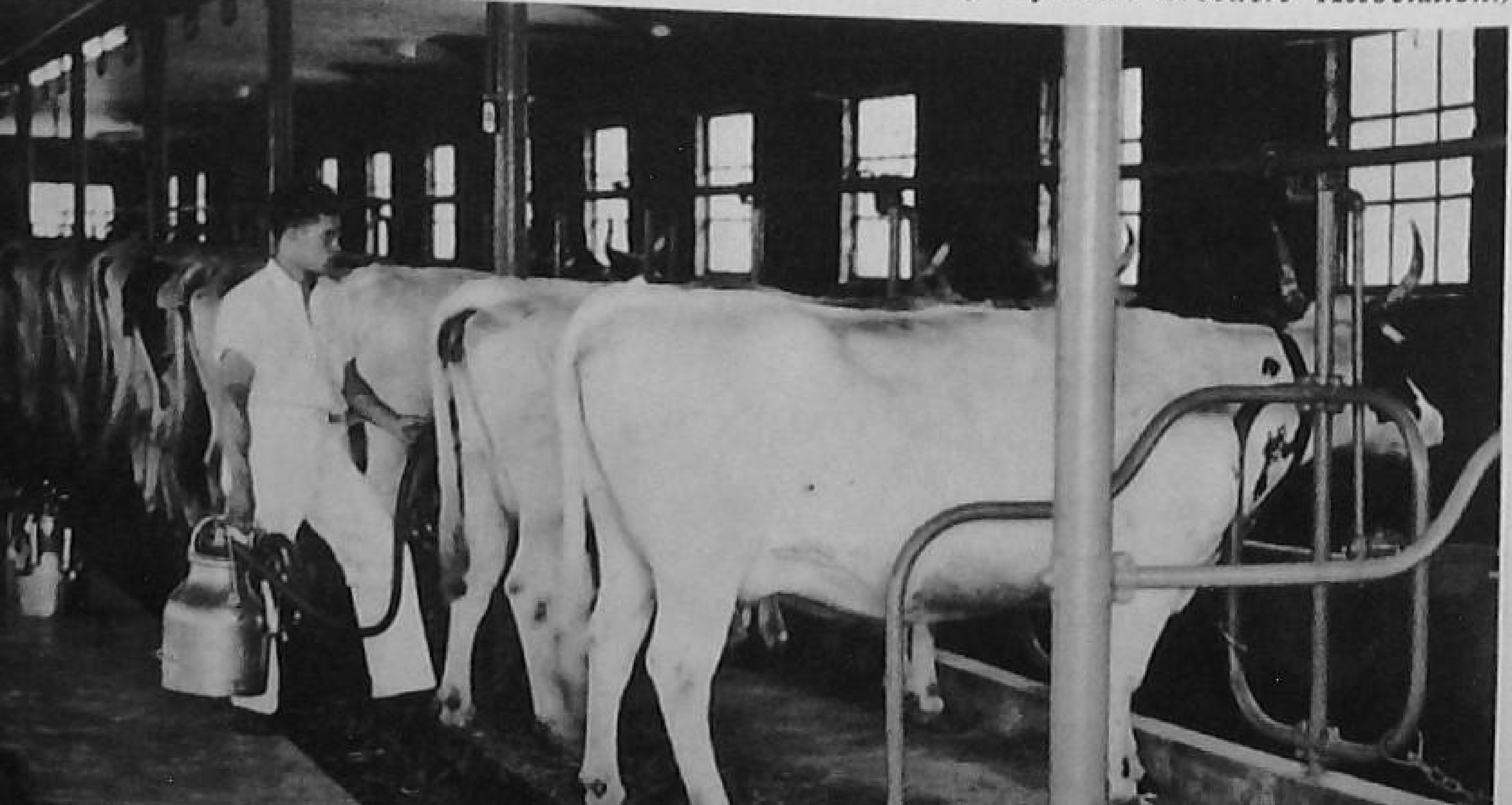
Sanitation. The presence of bacteria in milk will reduce the length of time it may be kept and may even make it unfit for human consumption.

The cows, especially their udders and flanks, should be cleaned at milking time. The yards should be well drained and clean. The barn floor should be made of concrete and kept clean.

The utensils and milking equipment should be made of tinned iron or stainless steel that is in good condition.

The milk house should have a concrete floor, sloped for drainage. It should be separate from the barn and have wash and rinse vats, hot water, storage racks for utensils, and a tank for cooling and storing milk. The milk house should be screened and well ventilated.

FIGURE 184. *A stanchion-type barn. (Courtesy Ayrshire Breeders' Association.)*



The water supply for washing utensils and cooling the milk should be free from pollution. Wells should be protected from pollution from outdoor toilets, sewer lines, and from surface water. Fly-tight, outdoor toilets are recommended.

Cooling facilities. Bacteria multiply very slowly in cold milk. Milk should be cooled immediately after milking to 50° F. or lower.

PRODUCING GRADE A MILK

The methods recommended in this section are just as applicable to the production of quality cream as to the production of Grade A milk.

Maintaining a Healthy Herd. Test the herd regularly according to the ordinance requirements for tuberculosis and Bang's disease. A veterinarian's statement certifying that the herd is free from both diseases is necessary. Cows that have swollen or sore udders, or those that produce abnormal milk, should be removed from the herd.

Housing Facilities. If a stanchion-type barn is used, it should be clean, adequately lighted, and well ventilated, and have a concrete floor. From 400 to 500 cubic feet of air space is needed per cow.

FIGURE 185. *A pipeline milking system in operation. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

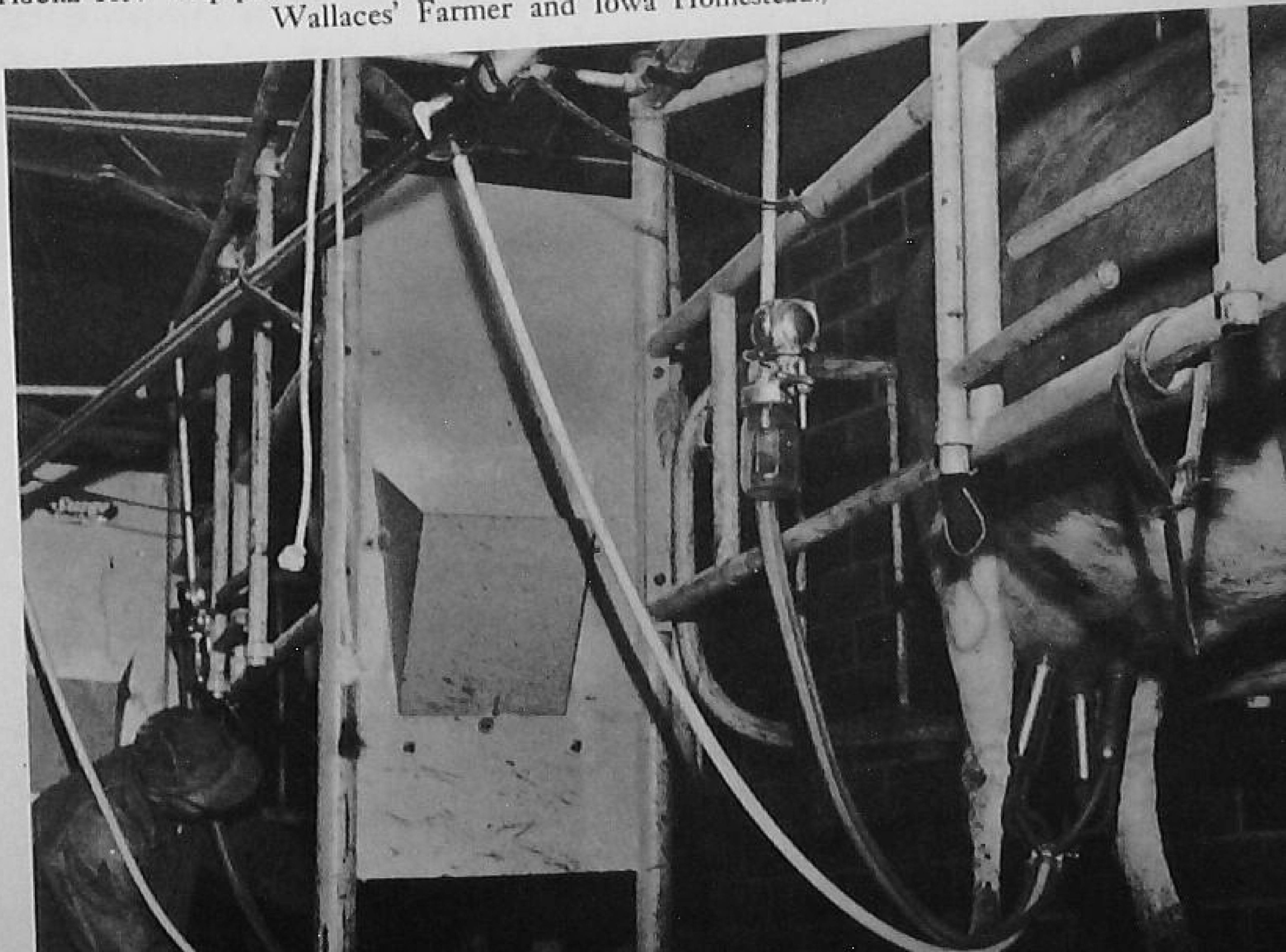


FIGURE 186. *Milk house attached to the barn. (Courtesy Iowa State College, Agricultural Extension Service.)*

The interior of the barns should be kept free from dust and cobwebs. It should be whitewashed once each year or painted each two years. Manure should be removed from the barn daily. Lime should be used in gutters and on the passageways.

Under the loose-type housing system, from 50 to 75 square feet of floor space should be provided for each cow. Adequate bedding is essential. A milking parlor with a cement floor and proper drainage should be provided.

Milk House. The milk house should be located near the milking parlor or barn but should not open directly into the barn. The doors and windows should be screened, and the doors should be self-closing. The floors should be of concrete and well drained. The window area should be at least 10 per cent of the floor area. The walls and ceiling should be finished and painted. A house 10 x 12 or 12 x 16 feet is recommended, depending upon the size of the herd.

Cooling Facilities. Bacteria that cause souring and undesirable flavors in milk grow ten times as fast at 90° F. as at 50° F. The milk should be cooled as soon as possible after milking. Since water cools twenty times faster than air, a cooling tank, adequate in size to take care of the volume of milk produced, should be provided, or a mechanical cooler should be used. Plans for cool-

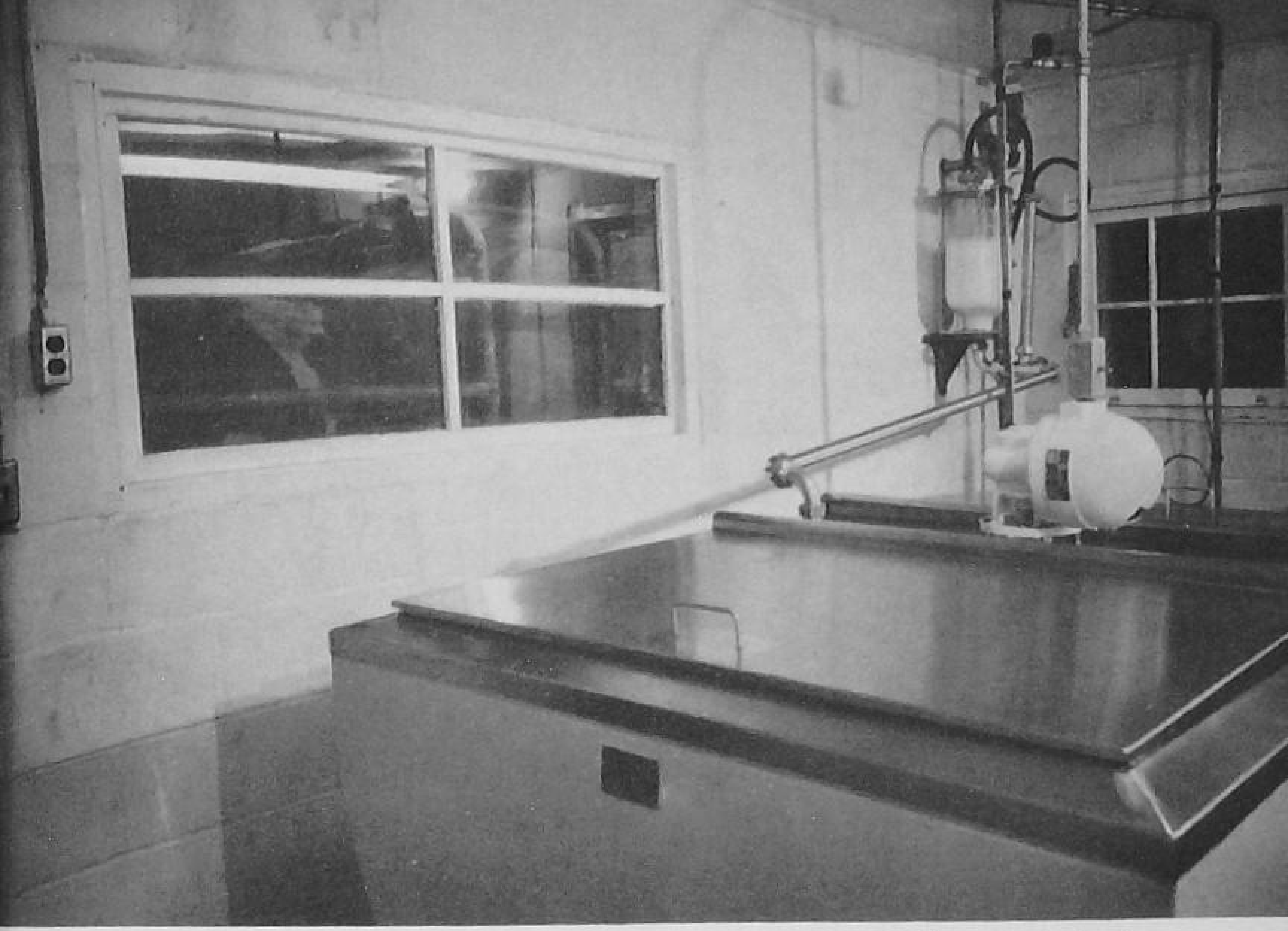


FIGURE 187. *Mechanical milk cooler. (Courtesy Iowa State College, Agricultural Extension Service.)*

ing tanks are available from your state agricultural extension service.

The cooler should lower the temperature of the milk to 50° or 55° F. within an hour. Cold water from a well or a mechanical cooling unit may be used. If water is used, have the water level in the tank high enough to cover the cans to the neck.

Utensils. Seamless or electric-welded pails made of noncorrodible metals should be used. Milk strainers of an approved type with single-service filtering pads are recommended.

When utensils are not in use they should be stored on racks in an inverted position in the milk house.

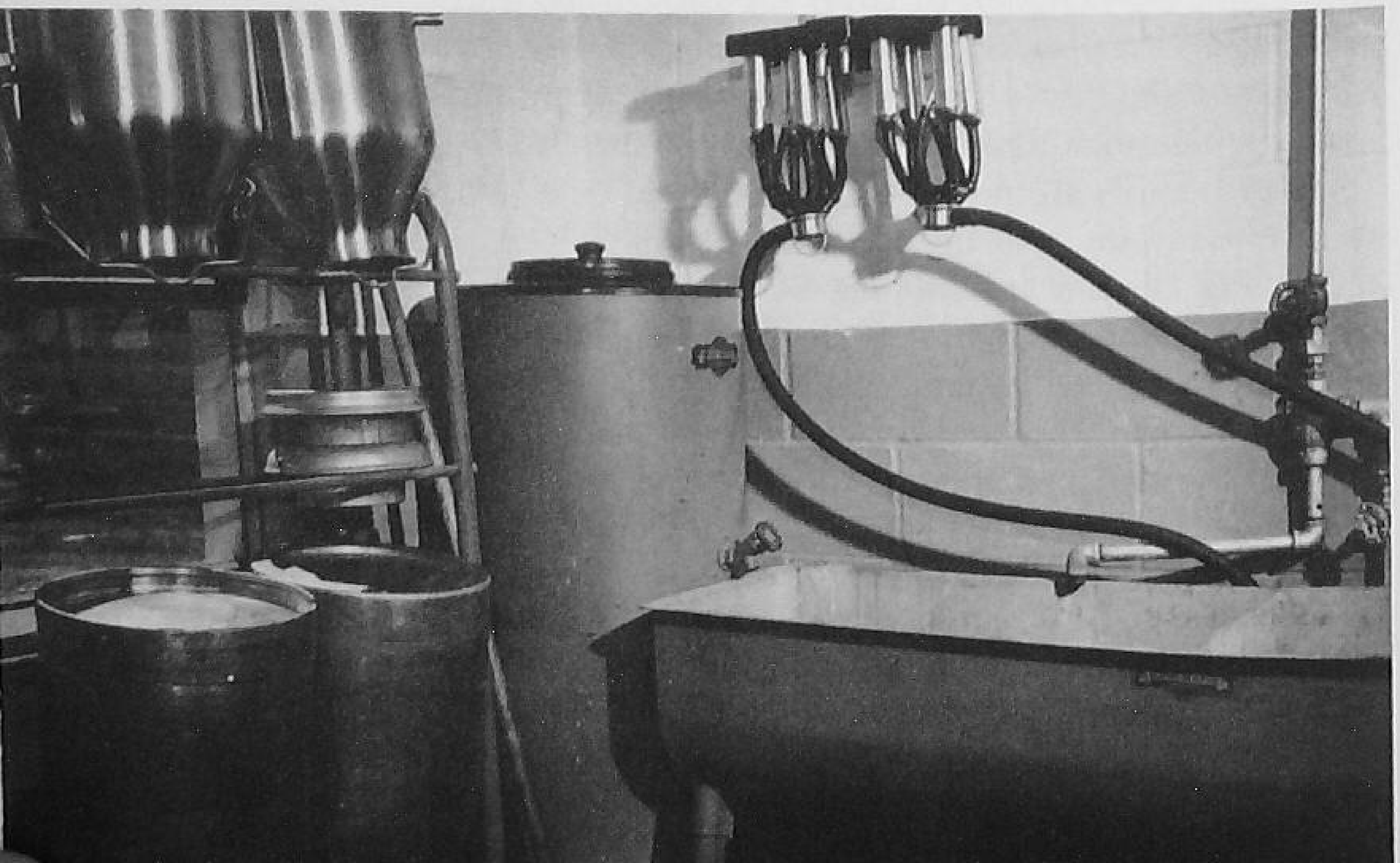
Cleaning Utensils and Milking Machines. The milking-machine teat cups, tubes, pails, and strainer should be rinsed thoroughly immediately after each milking to remove milk film. Following the rinsing, the utensils should be washed with warm water containing a suitable washing compound or wetting agent. Soap should not be used because it leaves a greasy film. The surfaces of the utensils should be brushed with a stiff brush. After washing, rinse the utensils with hot or boiling water. Steam or chemical sterilizers may also be used.

Cleaning the milking machine. Be certain that all milking ma-

FIGURE 188. *Approved type milk strainer with single service filtering pads. (Wettach photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

chine parts are accessible for cleaning and are in a good state of repair. The milking machine parts are difficult to clean. Taking the machine apart and brushing all parts during washing is the best way to get them clean. After the teat-cup assembly and tubes have been washed, they may be rinsed with very hot water

FIGURE 189. *Milk room interior with equipment stored on racks. (Courtesy Iowa State College, Agricultural Extension Service.)*



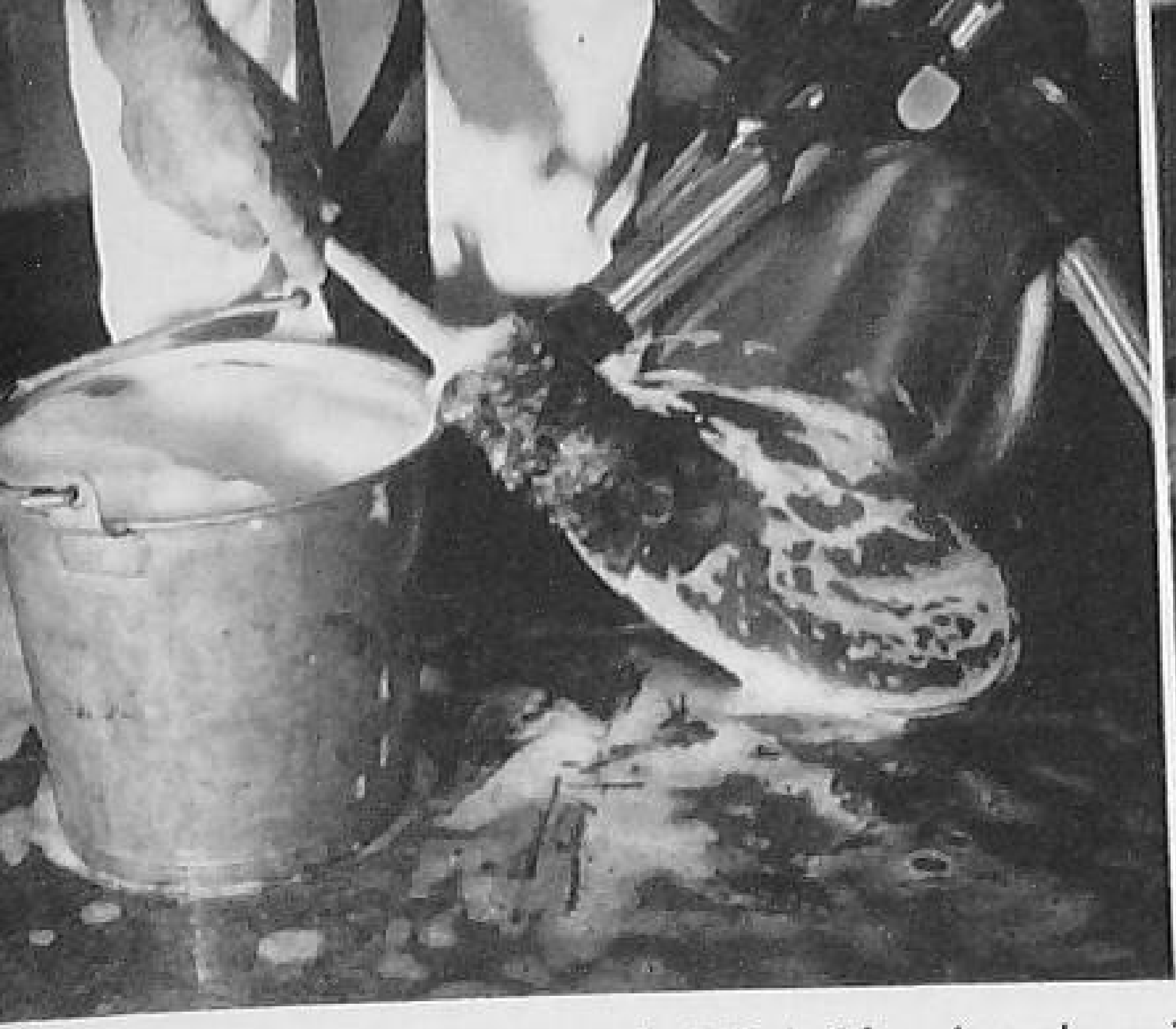


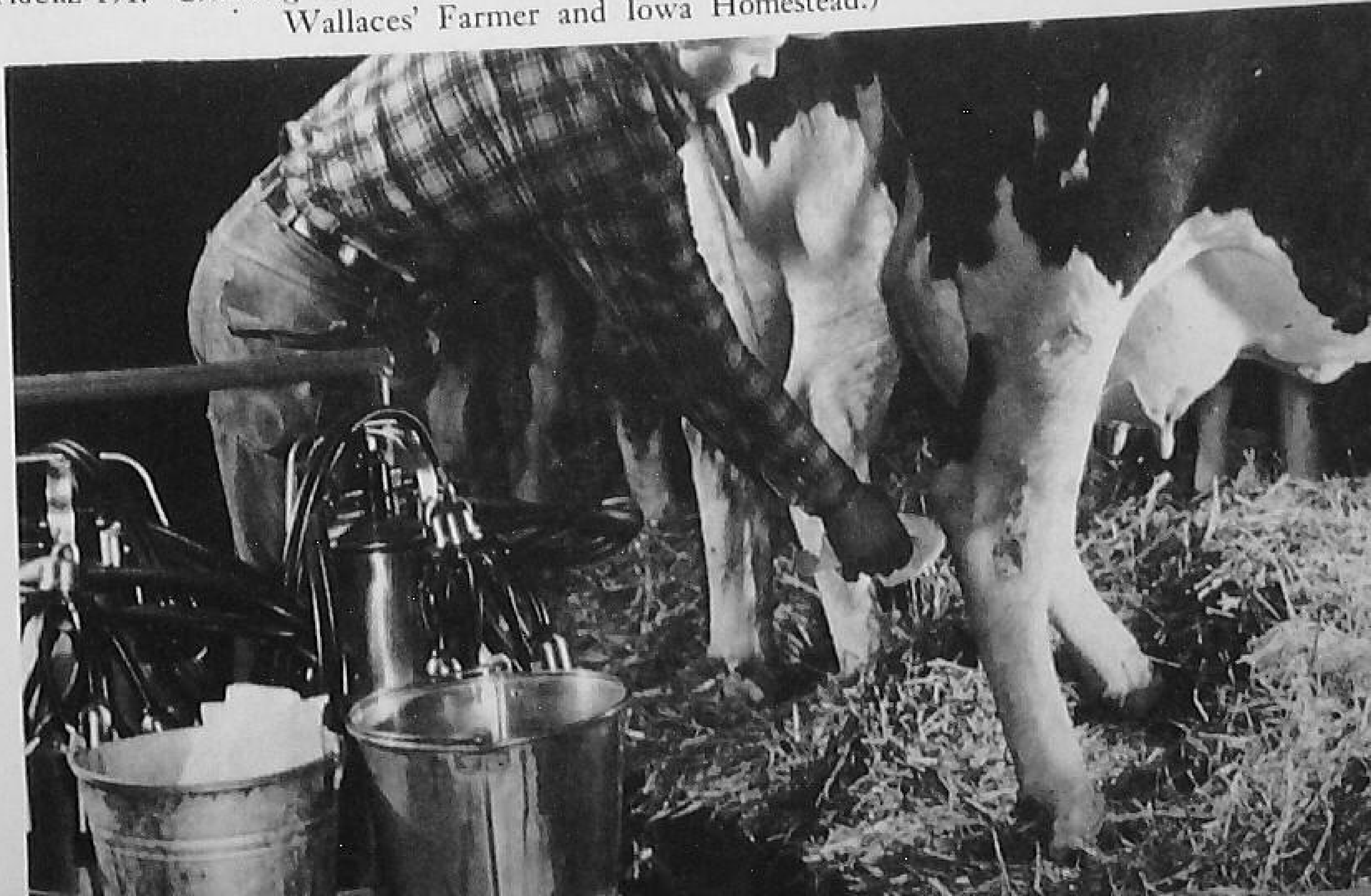
FIGURE 190. *(left and right) Cleaning the milking machine. (Courtesy Iowa State College, Agricultural Extension Service.)*

and hung up to dry, or they may be immersed in a 0.4 to 0.5 per cent lye solution. All parts treated with lye solution should be thoroughly rinsed with clean water before they are used again for milking.

The lye solution should be made up in an earthenware jar by adding one 13-ounce can of lye to one gallon of water. One cup of this solution should be used with each gallon of water to make up the 0.4 or 0.5 per cent solution.

Cleaning the Cows. The udders of the cows should be washed and wiped with a chlorine sterilizer solution just before milking. A dirty udder provides a source of sediment and bacteria. Some

FIGURE 191. *Cleaning the cow's udder before milking. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)



dairymen brush their cows daily and clip the long hair from the legs, flank, and udder.

Milking. If milking is done by hand, the hands should be clean and dry. Wet-hand milking is not a good practice. A teat cup should be used before milking to see if the milk is normal. Only milk of high quality should be marketed.

COST IN CHANGING TO GRADE A MILK PRODUCTION

A survey in the Omaha–Council Bluffs milkshed indicated that about 70 per cent of nearly 2000 milk producers had changed production methods so that they could produce Grade A milk. Table 37 shows a summary of the average cost of the changes made by dairymen who were already producing market milk.

TABLE 37

MAJOR COSTS TO CONVERT TO GRADE A MILK *
(Omaha)

Items	*Average Cost*
Mechanical cooler	$ 408
Barn construction and/or alteration	331
Milk house construction and/or alteration	242
New milk utensils	172
Cleaning utensils (Water, heater, water vat, water rack)	132
Other costs (Installation of water system and drainage system)	88
Total	$1373

* Henry A. Homme, Eddie Easley, and John Shaul, "If You Are Thinking of Going Grade A," *Iowa Farm Science*, November 1952.

IMPROVING THE QUALITY OF CREAM

In general, the methods recommended in the production of Grade A milk are applicable to the production of cream. The milk should be separated as soon as possible after milking, and the cream should be cooled immediately in the cooling tank or refrigerator. Dust and any undesirable aroma should be kept out of the cream can but a tight lid should not be used. Cream should be sold as sweet cream.

The cream separator should be housed in the milk house and given the same treatment in cleaning and sterilization that was recommended for the milking machine.

SUMMARY

Dairy income can be increased by (1) planning production so that milk and butterfat can be marketed during the seasons of high prices; (2) selecting the form in which to sell the products that will yield the largest net return; and (3) improving the quality of the products to be sold.

About 40 per cent of a cow's production is during the first four months after calving. Milk and butterfat prices are highest in November, December, and January, and lowest in April, May, and June. Cows should be in peak production in November, December, and January.

Each dairyman must analyze his production and marketing system to determine whether to sell milk or cream. Most dairymen report greater profits from the sale of Grade A milk. The specifications for Grade A milk listed by the U. S. Public Health Service Ordinance are now required by most cities. The ordinance requires a minimum of bacteria in the milk and an inspection of the herd, barn, milk house, equipment, and of the milking process.

To improve the quality of dairy products, the herd should be free from disease, the barn should be sanitary, well ventilated, and adequate in size. The milk house should be separate from the barn, should be sanitary, and should provide an abundant supply of water. The separator, milking machine, and utensils should be thoroughly washed and disinfected after each milking.

A milk-and-cream cooler or cooling tank should be provided. Dairy products should be cooled to 50° or 55° F. within one hour after milking.

The cow's udder should be washed and disinfected and strip cups used before milking.

The cost of converting to the production of Grade A milk ranges from $700 to $1500 per farm.

QUESTIONS

1. When should you have your cows freshen to be able to market milk and butterfat at the highest prices?
2. What is meant by the butterfat feed price ratio?
3. What changes should you make in the seasonal production and marketing of dairy products on your farm?
4. Which is the best way for you to market milk on your farm—as milk or as butterfat? Why?

5. Outline the requirements for Grade A milk production.
6. What changes would you need to make in your production and marketing program to be able to market Grade A milk? What would these changes cost?
7. Outline a program for properly cleaning the cream separator, milking machine, and utensils.
8. Describe a desirable milk house.
9. Plan a cooling tank which will meet the needs on your farm.
10. Outline a program for improving the marketing of dairy products on your home farm.

REFERENCES

Baker, M. P., *Producing Grade A Milk for Pasteurization*, S-685, Iowa State College, 1951.

Huff, K. B., and others, *Specifications for the Combination Milking Barn and Milk House*, Circular 606, University of Missouri, 1951.

Iowa State College, *The Farm Milkhouse*, Pamphlet 126, 1947.

Iowa State College, *How to Produce Grade A Milk*, Pamphlet 168, 1951.

Jacob, A. W., *Improving the Market Value of Milk and Cream*, Circular 404, Oklahoma A & M College, 1945.

Petersen, W. E., *Dairy Science*, J. B. Lippincott Company, Philadelphia, 1950.

U. S. Department of Health, Education and Welfare, *Milk Ordinance and Code*, Washington, D. C., 1953.

Profitable Production of Dual-Purpose Cattle

< 21 >

Breeding and Management of Dual-Purpose Cattle

Dual-purpose cattle have been bred and developed as intermediate breeds between the strictly dairy and beef breeds. The breeds of dual-purpose cattle will not equal the dairy breeds as economical producers of milk. They are not equal to the beef breeds as producers of beef. They are, however, better producers of milk than are the beef breeds, and they will produce a better carcass than will the dairy breeds.

Adaptability of Dual-purpose Cattle. Dual-purpose cattle are well suited to the small farms where a monthly milk or cream check is desired and there is surplus grain for fattening a few cattle. Many large-scale farm operators who are not equipped for specialized dairying and whose cattle cannot be given the care required for high-producing dairy cows have turned to dual-purpose cattle. Dual-purpose cattle provide an opportunity to make a quick shift from dairy to beef or vice versa. Animals that are to

FIGURE 192. *These Red Poll steer graded good to choice when sold as slaughter cattle. (Courtesy Red Poll Cattle Club of America.)*

be disposed of will do very well in the fattening lot. Experiments show that dual-purpose cattle will finish into good to choice slaughter animals. The dual-purpose cattle breeder of grade animals need not veal his bull calves, as many dairymen do, but may grow them out and fatten them for market.

Cows that have completed their usefulness as milk animals and those culled from the milking herd will fatten up and bring a good price for cow beef.

SELECTING A BREED

The same general principles of breed selection apply for dual-purpose cattle as for other breeds of livestock. They are: (1) personal likes, (2) availability of breeding stock, (3) outlet for surplus animals, and (4) environmental conditions under which the cattle will be raised.

BREEDS OF DUAL-PURPOSE CATTLE

Three breeds of dual-purpose cattle are relatively common in the United States—Milking Shorthorns, Red Poll, and Devon.

Milking Shorthorns. The Milking Shorthorn cattle were first developed in England and came from much the same parent stock as did the beef Shorthorns. As a result of a different emphasis by the breeders in developing the strains, the chief dissimilarity between the beef and Milking Shorthorns came about. In the case of the milking strain, the emphasis was divided more evenly between beef and milk. The result was a shorthorn cow possessing

FIGURE 193. *Model type Milking Shorthorn bull. (Abernathy photo. Courtesy American Milking Shorthorn Society.)*

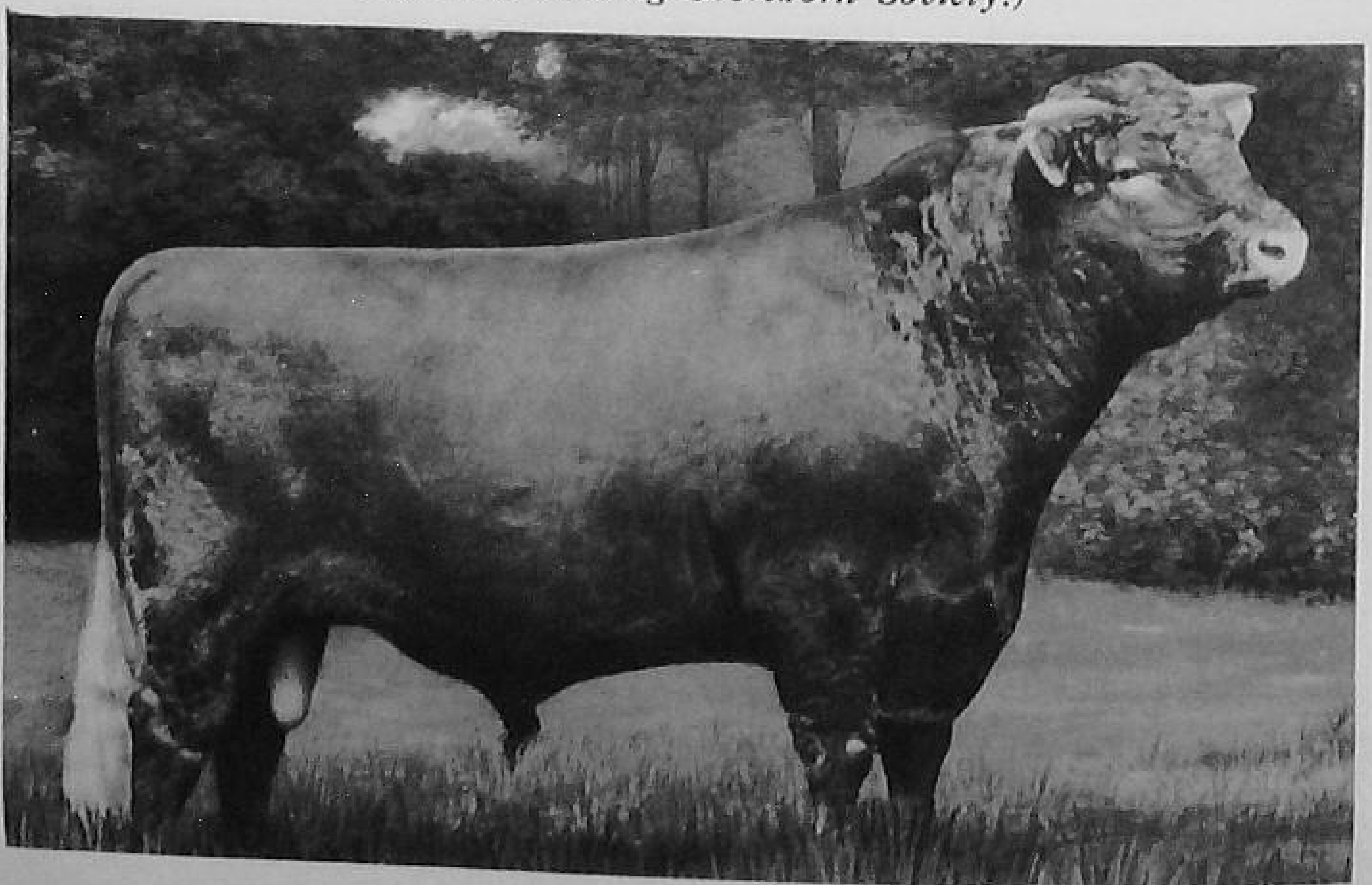


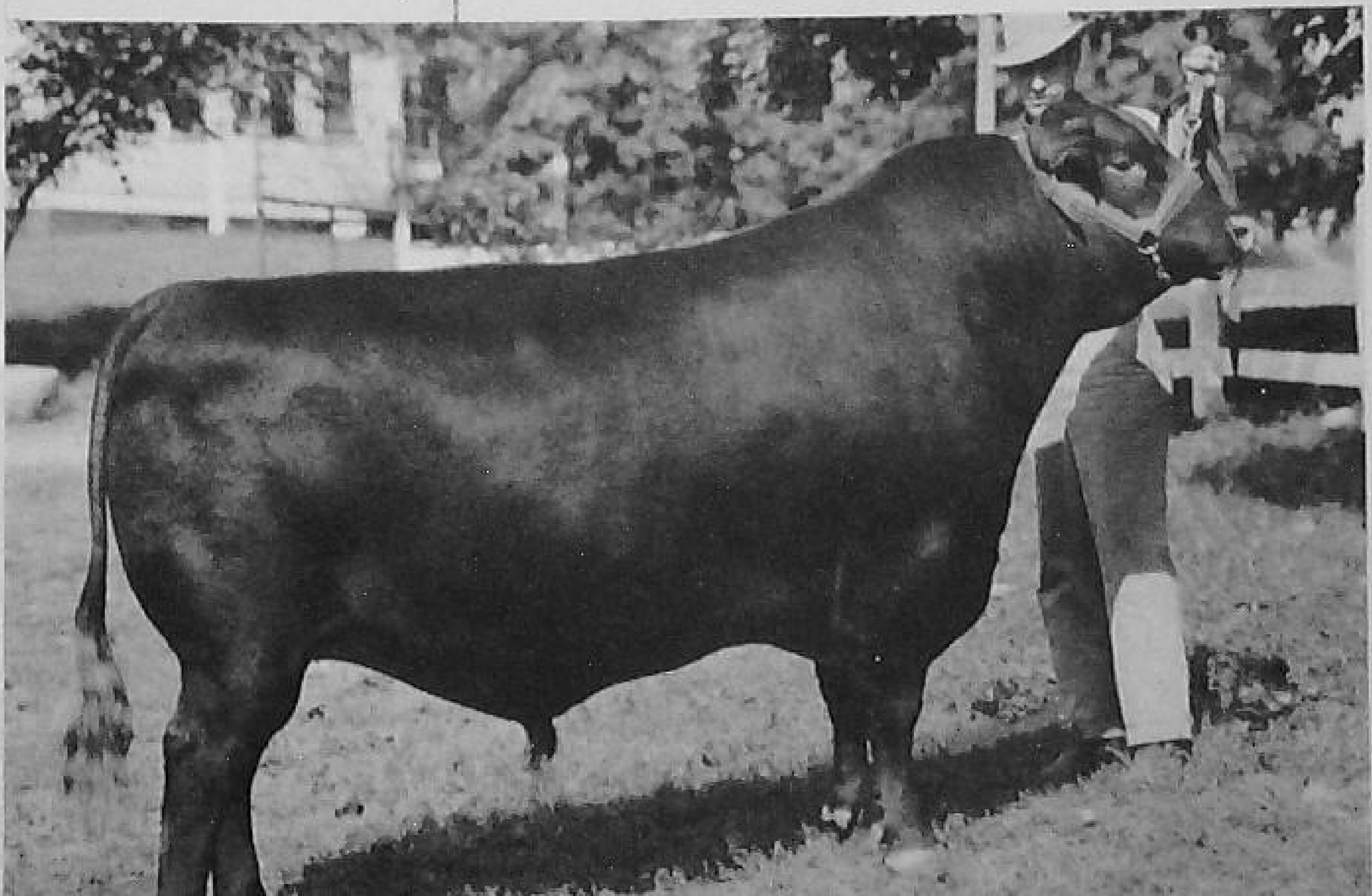
FIGURE 194. *Model type Milking Shorthorn cow. (Abernathy photo. Courtesy American Milking Shorthorn Society.)*

good milking qualities but lacking some of the excellent qualities of the beef strain.

The Milking Shorthorn is red, white, or any combination of these colors. There are two strains of Milking Shorthorns, polled and horned. The polled animals were developed from "mutants" or animals that were naturally polled even though they were born of parents having horns. The polled strain has the same characteristics as the horned cattle except for the poll.

Red Poll. The Red Poll cattle were developed in England by merging the Norfolk and Suffolk strains of cattle. They are solid red in color, hornless, and quite compact in body form. They are good milkers, and will do well in the fattening lot. The Red

FIGURE 195. *A champion Red Poll bull. (Strohmeyer & Carpenter photo. Courtesy Red Poll Cattle Club of America.)*



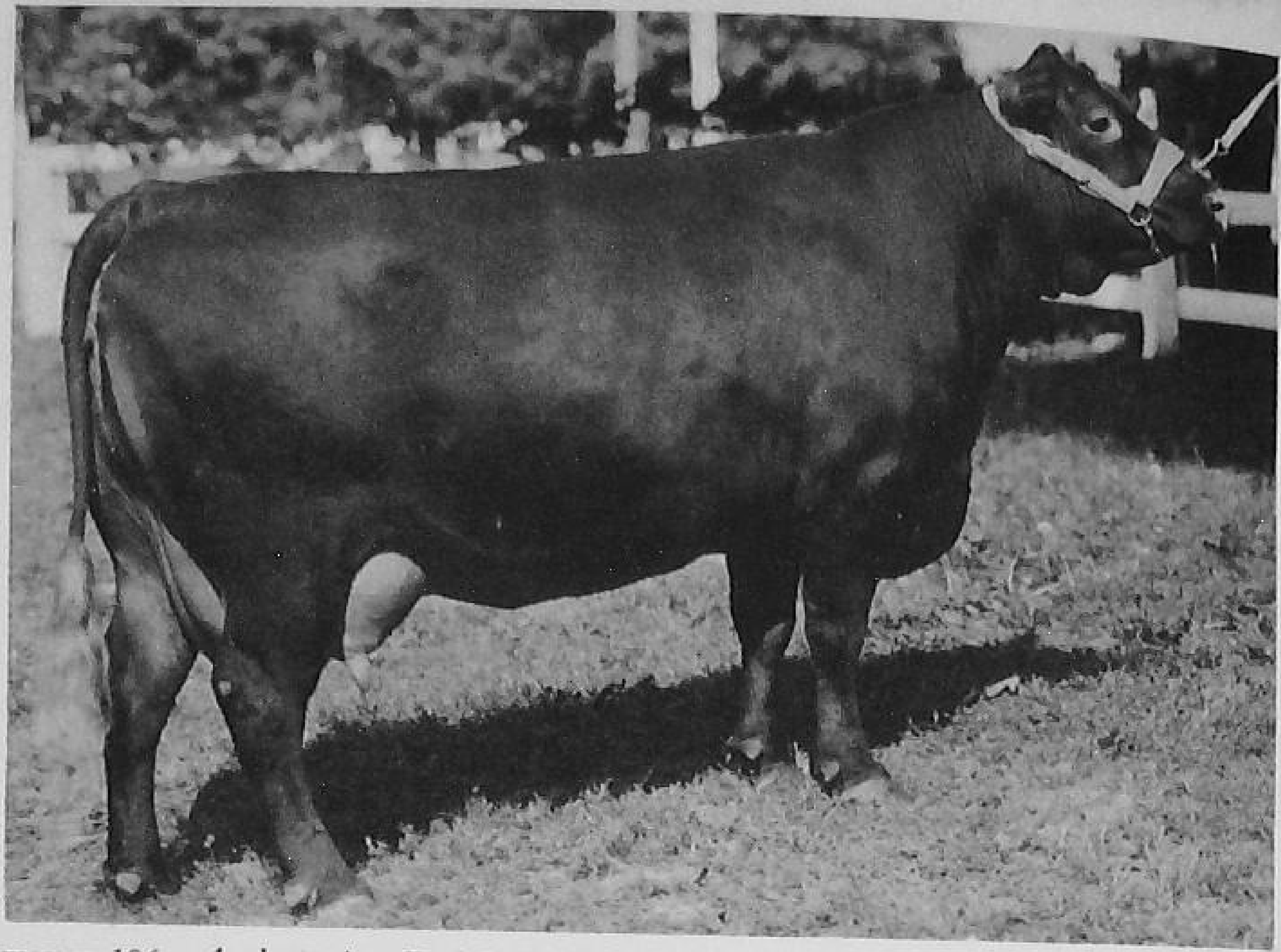


FIGURE 196. *A champion Red Poll cow. (Strohmeyer & Carpenter photo. Courtesy Red Poll Cattle Club of America.)*

Poll is popular among dual-purpose cattlemen.

Devon or Ruby Reds. The Devon cattle were developed in England, and are one of the oldest of the English breeds. The Devon is probably the first of the dual-purpose breeds introduced into America. Records show that several importations of Devon cattle were made into this country during its early history. The Devon cattle are red in color. The skin is yellow and the head supports medium-sized horns that are creamy white with black tips and curve upward.

The cows are good milkers, producing a product testing about 4.5 per cent butterfat. Cattle placed in the fattening lot have produced good to choice beef.

Selection of Breeding Stock. It has been explained that the ob-

FIGURE 197. *Devon bull. (Courtesy American Devon Cattle Club.)*

jective of the breeder of dual-purpose cattle is to combine good milking and beef qualities into the same animal. In the selection of breeding or foundation stock both the beef and dairy qualities must be considered.

Using Production Records in Selection of Breeding Stock. The most reliable method of determining a cow's ability to produce is her production record or the records of her ancestors.

In selecting dual-purpose cattle both their records of milk production and their ability to produce beef should be taken into consideration. Many herds of dual-purpose cattle have been on test in dairy herd improvement associations. It is not difficult to find animals with good milk production records back of them.

FIGURE 198. *Devon cow. (Courtesy American Devon Cattle Club.)*

Other Factors to Consider in Selection. Since the dual-purpose animal should produce both beef and milk economically, this ability should be apparent in the animals selected for breeding purposes. The mammary system should be well-developed. The body form is intermediate between the beef and dairy types. The legs should be medium short, the body compact, the top and underline straight. The covering of flesh should be uniform, less than that of beef animals but more than that generally found in the dairy breeds.

FIGURE 199. *Group of Milking Shorthorn cows.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)

SUMMARY

Dual-purpose cattle are adapted to both milk and beef production. The breeds do not equal dairy cattle in milk production nor beef cattle in beef production. Many farmers, not wishing to specialize in either dairy or beef cattle, have found the dual-purpose breeds satisfactory.

There are three common dual-purpose breeds in the United States. They are: Milking Shorthorns, Red Poll, and Devon.

In body form, dual-purpose cattle are intermediate between the dairy and beef types.

QUESTIONS

1. Under what conditions would dual-purpose cattle be a wise choice?
2. Describe the general type of the dual-purpose cattle.
3. What would you consider in making a selection of foundation stock for starting a dual-purpose herd?
4. What are the common breeds of dual-purpose cattle?

REFERENCES

Baker, Marvel L., Arthaud, V. H., and Adams, C. H., *Feeding Milking Shorthorn Steers*, University of Nebraska, Lincoln, Nebraska, Agricultural Experiment Station, Circular 91, 1951.

Peters, W. H., Fitch, J. B., Searles, H. R., and Morris, W. E., *Dual-Purpose Cattle*, University of Minnesota, Extension Bulletin 203, 1943.

Cattle Diseases and Parasites

< 22 >

Keeping Cattle Healthy

Cattle diseases, parasites, and other ailments may be divided into four groups: (1) External parasites; (2) Internal parasites; (3) Infectious diseases; and (4) Noninfectious ailments. The average cattleman is not a veterinarian; therefore, his chief duties in maintaining a healthy herd are good sanitation, the use of sprays and disinfectants, and the vaccination of his herd against those diseases for which vaccines have been perfected.

PROGRAM OF SANITATION

Most infections and diseases that cattle are subject to are brought into the herd as a result of poor management practices. Parasites and disease germs usually breed best under filthy conditions. Many diseases spread from infected animals to healthy ones. The following steps are important if a disease- and parasite-free herd is to be maintained:

1. Bring only clean animals into the herd. Many serious diseases, such as brucellosis, can be detected through a test for the disease. A veterinarian may save serious losses if called to examine animals before they go into the herd.
2. Drain lots so that they will remain dry and free of stagnant water.
3. Isolate all animals that are known to have contagious infections.
4. Have the breeding herd tested at least once a year for brucellosis, tuberculosis, and other diseases for which tests have been developed.
5. Vaccinate for diseases common in the community if a successful vaccine exists.
6. Disinfect housing and equipment regularly.

7. Treat open wounds and the navel of newborn calves with a reliable disinfectant.
8. Provide plenty of exercise for the breeding herd.
9. Spray or dust for external parasites, such as flies.
10. If cows calve in places other than clean pasture, be sure the area is well bedded and disinfected.

Remember the old adage that "an ounce of prevention is worth a pound of cure"—and is a lot cheaper. Extreme caution may seem to be time-consuming and expensive, but many diseases in the herd can force a man out of the cattle business.

EXTERNAL PARASITES

The Screw Worms. Screw worms are prevalent in the southern and southwestern states. In these areas they are one of the most important causes of cattle losses.

Life history. The screw worm fly is bluish green in color, with orange shading below the eyes. Three prominent dark stripes along its back distinguish it from other similar insects. The flies lay their eggs in masses along the edges of open wounds. The eggs hatch into tiny maggots that burrow into the flesh, where

FIGURE 200. *Screw worm infestation of a calf. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

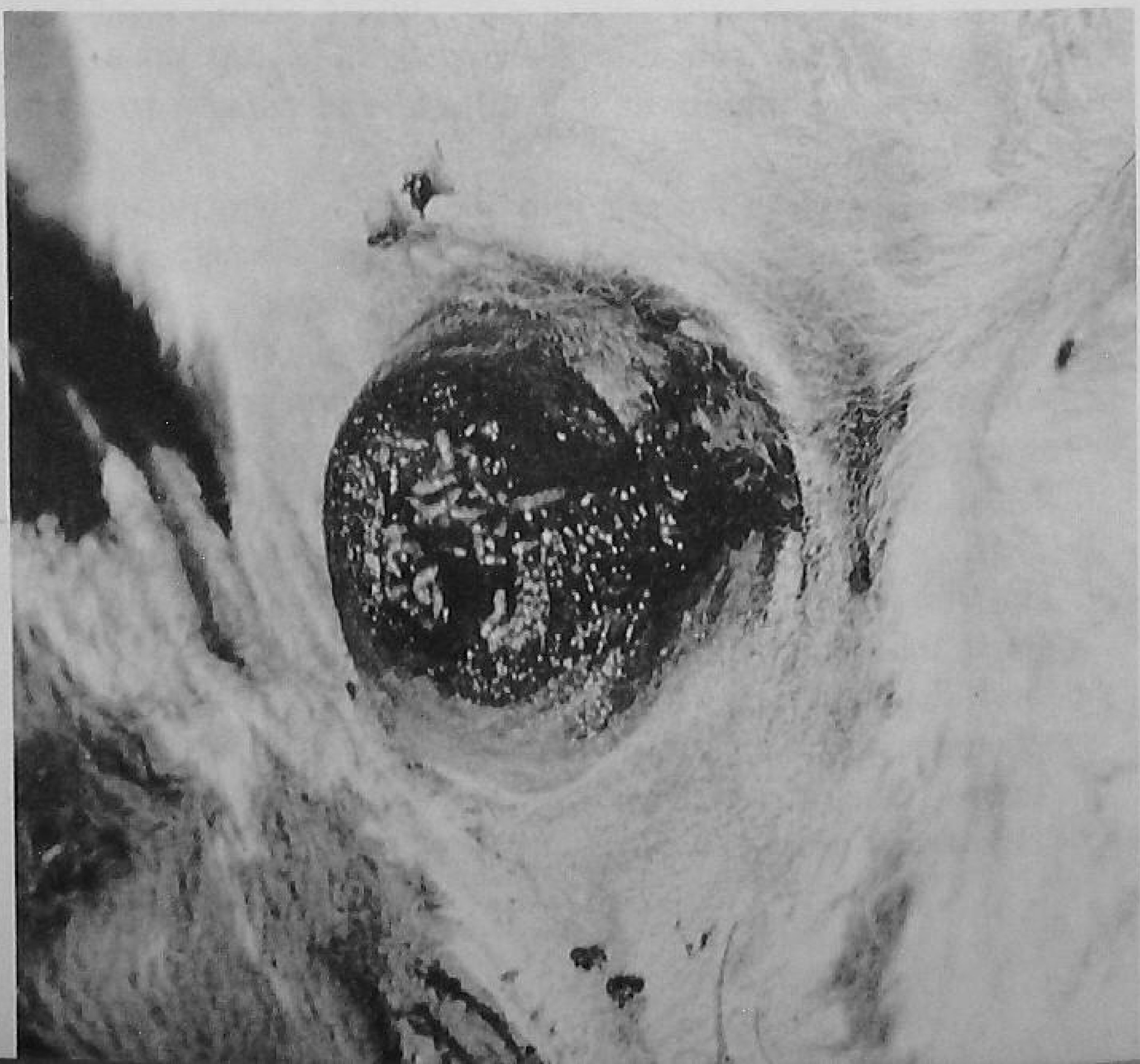


FIGURE 201. *Dusting for cattle grubs. (Courtesy Tony Fellhauer, University of Wyoming.)*

they feed from four to seven days. When the worms have reached their full growth, they drop to the ground and burrow into the soil. A few days later they emerge from the pupa or dormant stage into the adult fly. The entire life cycle may be completed within twenty-one days under favorable conditions.

Prevention and control. The United States Department of Agriculture has developed several smears that will kill the worms or prevent their infecting wounds. The newest of these smears is known as "Smear EQ 335." The ingredients consist of the following: lindane, 3%; mineral oil, 40–44%; pine oil, 35%; emulsifier, 8–12%; and silica aerogel, 8–12%. This mixture should be applied to the surface of all open wounds, and deep into the wound.

Dehorning, castrating, and other operations should be performed during the winter season when the screw worm is less active.

Grubs. Cattle grubs or heel flies seldom cause death in cattle, but the loss resulting from the uncomfortable effect they produce upon the animals is greater than is generally realized by herd owners.

Life history. The heel fly lays its eggs on the lower parts of the animal during spring and early summer. The eggs hatch, and the tiny grubs bore through the skin and migrate through the animal's body, feeding on the tissues for about nine months. They appear as lumps along the back from early winter until spring. The mature grubs come out of the openings in the hide, drop to

the ground, and soon develop into adult flies. These flies seldom travel more than a mile, so if cooperative effort is made they can be controlled in any area.

Prevention and control. The most effective control has been given by a rotenone dust or spray.

When dusting use a one to 2 per cent rotenone dust. The first dusting should be done about twenty-five days after the first lumps appear, and at thirty-day intervals until all lumps are gone. The hair should be roughed up with a brush and the dust applied along the back, working it down to the skin.

Spraying is quicker where large herds are to be treated. If a spray is preferred, 7½ pounds of 5 per cent rotenone dust plus about 2 pounds of wetting agent (Dreft, Vel, etc.), in 100 gallons of water should be used. One gallon of spray per animal at from 300 to 400 pounds of pressure should be applied and the spraying repeated at thirty-day intervals.

Cattle Lice. Cattle lice are most abundant during the winter. Cattle infested with lice rub along fences and feed bunks in an effort to relieve the irritation. Gains and milk production are slowed down.

Prevention and control. Spraying with rotenone over the entire body, using the same formula as for grubs, is effective in lice control. Only two sprays from sixteen to eighteen days apart are needed for beef cattle. Eight pounds of 50 per cent DDT wettable powder per 100 gallons of water will usually give complete control in one application if applied to all parts of the body. Other beef cattle sprays are toxaphene, 10 pounds wettable powder to 100 gallons of water, or 5 pounds of 40 per cent chlordane to 100 gallons of water. Dairy cattle in production should not be sprayed with DDT as there is some danger of the DDT residue occurring in the milk. One pound of 25 per cent wettable lindane powder to 100 gallons of water with two applications from eleven to fourteen days apart, or 8 pounds of 50 per cent methoxychlor in 100 gallons of water from eleven to fourteen days apart should be used.

Horn Flies. Horn flies are small black flies often seen resting in large numbers around the base of the horn. They suck the blood from around the back, shoulders, and withers, causing considerable loss of gain and reduction of milk.

Prevention and control. Horn flies may be controlled on range

FIGURE 202. *Calf infested with lice. (Bailey photo. Reprinted from* Successful Farming.)

or beef cattle by spraying with 8 pounds of 50 per cent wettable DDT powder in 100 gallons of water. High-pressure spraying is not necessary. One spraying should protect the animals for about three weeks. Methoxychlor is recommended for dairy cattle that are in production. The spray is prepared by using 8 pounds of 50 per cent wettable powder to 100 gallons of water or 2 gallons of a 25 per cent emulsion to 100 gallons of water.

Stable Flies. Stable flies feed on cattle, especially around the legs. They make the animals uncomfortable and reduce gains and production.

FIGURE 203. *Spraying cattle for fly control. (Bailey photo. Reprinted from* Successful Farming.)

Prevention and control. The same control measures as given for horn flies are effective. Pyrethrum is one of the most effective materials against stable flies. It is rather expensive for range cattle, but it is used to a considerable extent on dairy cattle. It can be purchased commercially as a spray.

The stable flies breed extensively under unsanitary conditions. Hauling out the manure and keeping barns clean during the fly season is essential if reasonable control is to be achieved. Spraying the interior of barns other than dairy barns with a 5 per cent DDT in oil emulsion at from six- to eight-week intervals is an effective control measure.

Recent experiments have shown that Malathon applied to the walls of barns and to corrals has been effective against flies that have built up a resistance to DDT. The spray consists of 2 gallons of 50 per cent emulsifiable Malathon in 2 gallons of white Karo syrup or 20 pounds of sugar to 100 gallons of water. The material is effective for from 10 to 20 days inside buildings. The material will not injure cattle that lick the walls. The spray should not be applied directly to animals or around the milk room of a dairy.

Cattle Ticks. Cattle ticks are the worst of the ticks that affect livestock. They carry the disease known as *Texas Fever,* which in the past has resulted in such heavy losses in the South. As a result of the work of the United States Department of Agriculture and the state experiment stations, Texas Fever has all but been eliminated from the United States.

Prevention and control. Control of Texas Fever lies in the eradication of the cattle tick. A 0.5 per cent toxaphene spray will destroy the tick and give protection to the animals for from two to three weeks.

Mites. Cattle mites produce what is known as *sarcoptic mange* or *cattle scab.* The mite spends its entire life cycle on the body of the animal, piercing the skin and feeding on the lymph. It produces a thickened, tough, wrinkled skin.

Prevention and control. Prevention consists of avoiding contact with infected animals. The control measure is the use of a lime-sulphur dip or lindane spray. Dipping three or four times about six days apart is necessary if lime-sulphur is used. Lindane has replaced lime-sulphur in many areas as a control measure for mange. The solution is made by mixing 8 pounds of 25 per cent

wettable powder and 2 pounds of wetting agent to 100 gallons of water.

INTERNAL PARASITES

There are several different types of stomach and intestinal worms that affect cattle, but the common stomach worm is the greatest menace.

Common Stomach Worm. *Symptoms.* Worms, similar to those found in sheep, may infect young cattle. Adult cattle are seldom affected. Heavily infested animals lose weight and become thin and weak. The hair becomes rough, and the membranes of the mouth are pale. A soft swelling, known as *bottle jaw*, may develop under the jaw.

Prevention and control. Sanitation is the most important means of prevention. Worm eggs pass in the droppings and hatch into tiny worms which are picked up by other animals. Placing water and feed where it will not become contaminated by droppings and a rotation of pastures are effective control measures.

Infested animals may be given a fluid drench, containing 10 grams of phenothiazine powder, at the rate of one ounce per 100 pounds body weight up to 500 pounds; for example, 2 ounces for a 200-pound calf, 3 ounces for a 300-pound calf, and so forth. The maximum dose should not exceed 5 ounces regardless of the animal's weight. Doses should be repeated every twenty days where heavy infestation occurs. The drench may be given with a syringe, placed in the side of the mouth and discharged near the base of the tongue.

INFECTIOUS DISEASES

There are many infectious diseases of cattle but only those that cause the greatest losses will be discussed in this book.

Brucellosis. Brucellosis or Bang's disease is Number One in importance, not only because of the economic losses resulting from the disease, but also because a disease known as *undulant fever*, which affects humans, may be contracted from animals affected with brucellosis.

Symptoms. Infected animals may abort or give birth to a dead or weak calf; this is the most commonly observed symptom of brucellosis. On the other hand, the birth may be normal, but the cow may fail to clean or expel the afterbirth. Animals that are

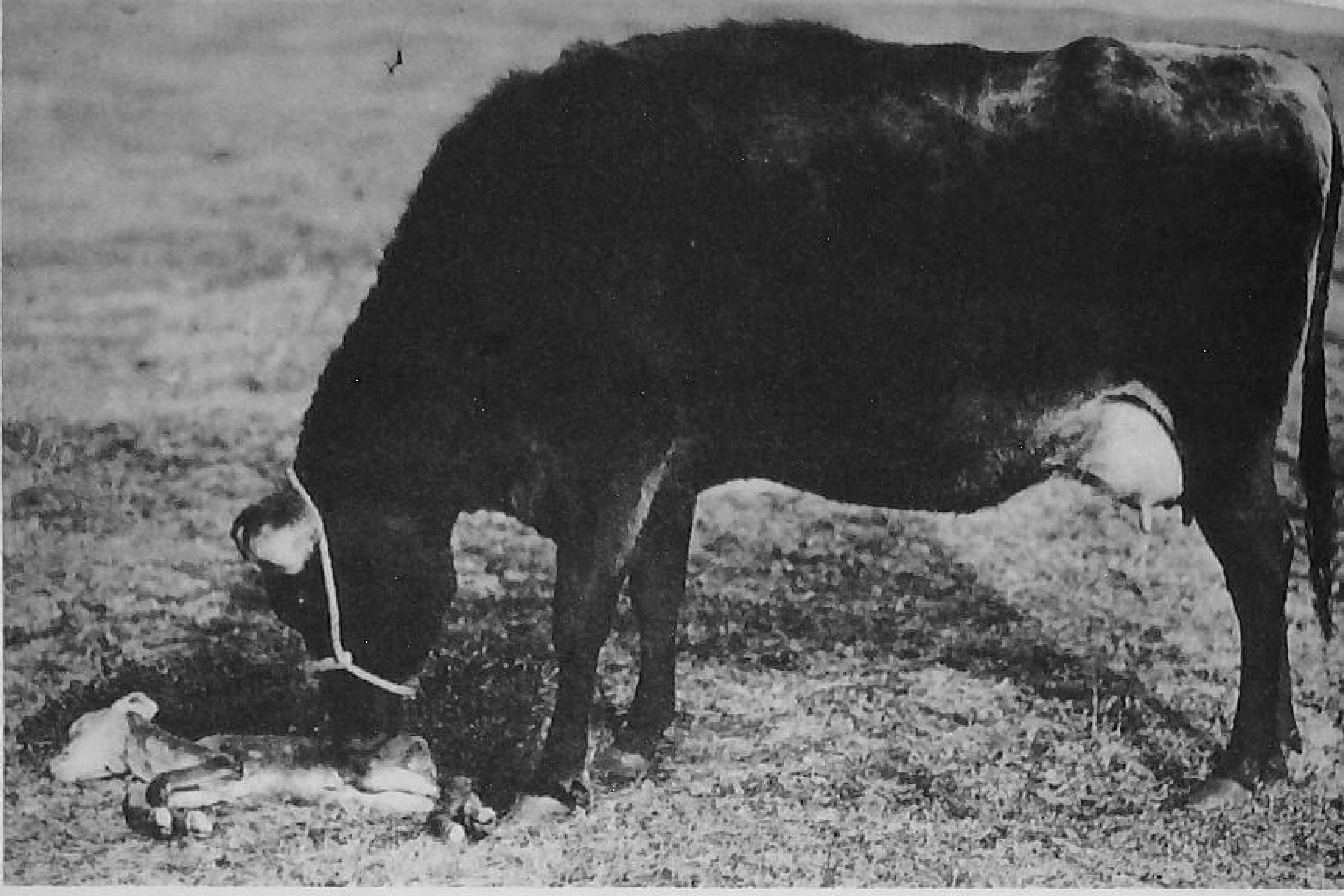


FIGURE 204. *Cow and aborted calf. The result of Bang's disease. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

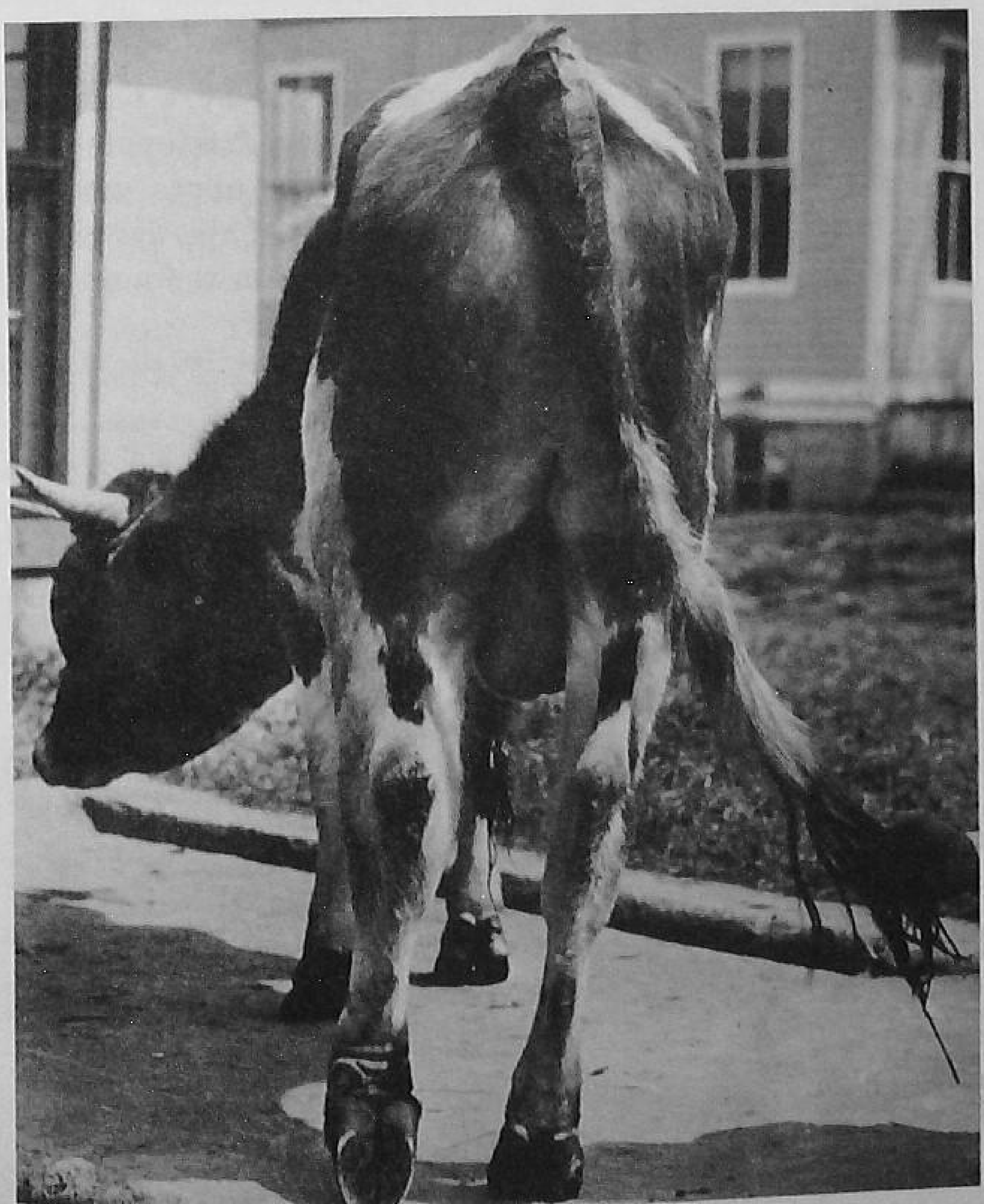
infected often have higher than normal temperatures at calving time. Milk production is reduced. Heavily infected herds may have 50 per cent or more aborted or dead calves among heifers. Great care must be taken by persons coming in contact with animals which are infected with brucellosis to avoid contracting undulant fever. The disease may be contracted from the consumption of milk produced by infected animals that has not been pasteurized, and great danger exists in handling newborn calves or aborted fetuses from infected herds.

FIGURE 205. *Vaccinating for brucellosis or Bang's disease. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

Prevention and control. Brucellosis may be detected by having a veterinarian test the herd. There are three recommended plans for the eradication of the disease.

1. Test all cows and heifers, removing any reactors from the herd and vaccinate all heifer calves between the ages of six and eight months. This plan is recommended where light infestation exists, or as a means of preventing the disease from getting started in the herd. It is especially recomended for dairy herds.
2. Test and keep all reactors separate from the herd and vaccinate the calves. Since cows will generally produce normal calves after the second calving, reactors may be kept, but should not be in the same area with heifers since they are carriers of the disease. The plan should be to eliminate the

FIGURE 206. *Calf with blackleg. Note the swelling in the leg. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



reactors as quickly as it is economically possible. This plan is not recommended for dairy herds.

3. Test at regular intervals and eliminate reactors without calfhood vaccinations. This plan may be used in very lightly infected herds.

Tuberculosis. Tuberculosis is a serious disease of cattle, but due to state-wide eradication programs it is steadily declining in the United States.

Symptoms. Many times animals will show no outward sign of the disease. There may be a gradual loss of weight, swelling of the joints, and labored breathing. The part of the animal affected has much to do with the outward symptoms.

Prevention and control. Tests have been perfected for determining the presence of tuberculosis in a herd. Periodic testing and the elimination of reactors constitute a reliable control program.

Blackleg. Blackleg is one of the most infectious diseases of young cattle and generally proves fatal.

Symptoms. Blackleg is usually accompanied by a high fever, loss of appetite, and labored breathing. Rapidly developing tumors under the skin that make a crackling sound, due to gas, when subject to pressure is one of the best indications of the disease.

Prevention and control. If blackleg infection is found in the

FIGURE 207. *Calf with shipping fever. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

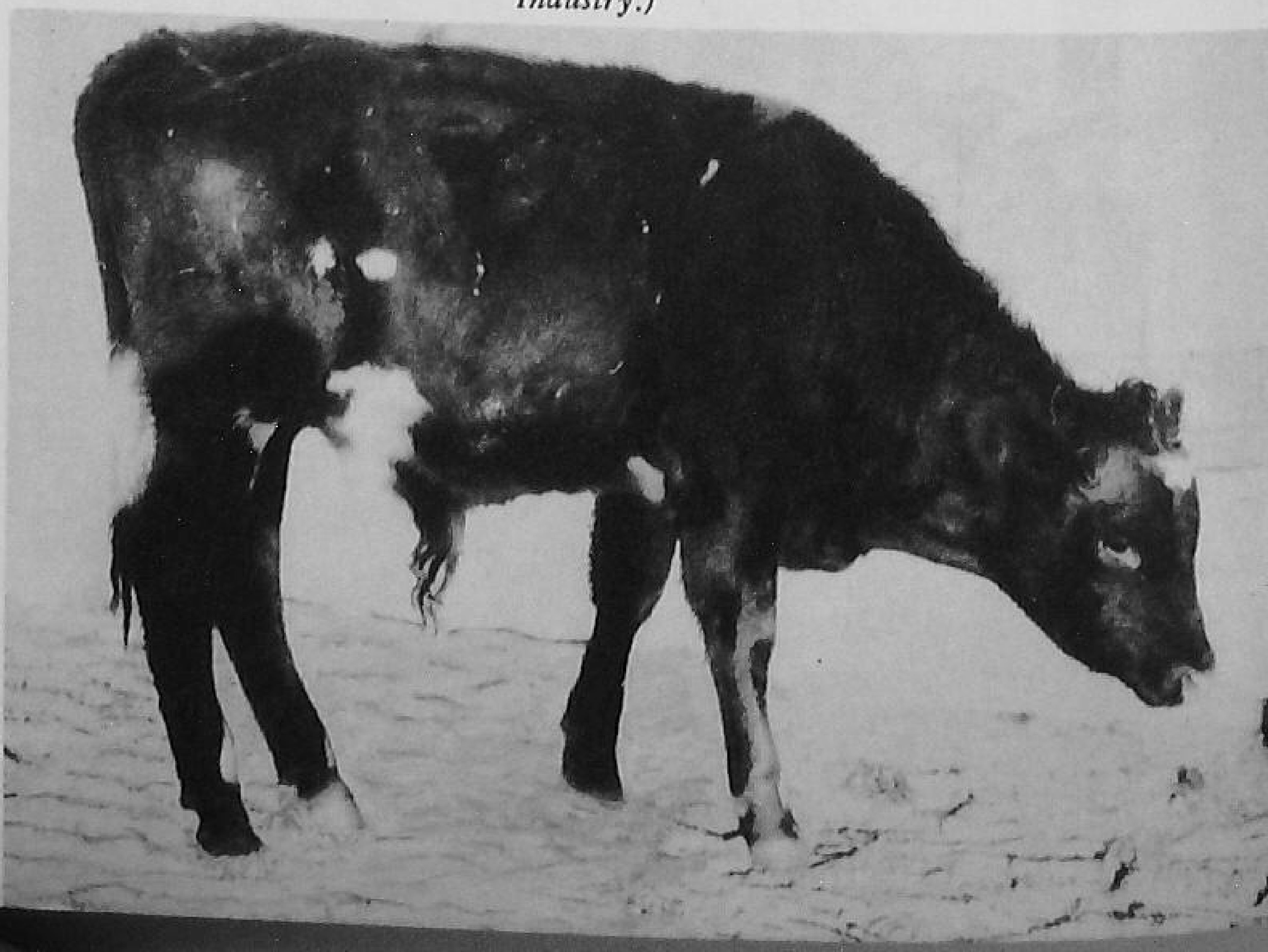


FIGURE 208. *Calf with pinkeye. Note the cloudy, watery condition of the eye. (Bailey photo. Reprinted from* Successful Farming.)

area or in the herd, vaccination of animals not affected is the only prevention. Affected animals will not generally respond to vaccination. If blackleg is suspected, a veterinarian should be called.

Anthrax. Anthrax outbreaks cost livestock men millions of dollars each year. The disease generally occurs during the summer. This period is known as the *anthrax season.*

Symptoms. Sudden death without apparent cause is the most striking symptom. High temperatures and bloody discharges from natural body openings are other symptoms.

Prevention and control. If an outbreak of anthrax occurs in the community, vaccination will give complete protection.

Shipping Fever. Shipping fever is a blood disease affecting mostly young cattle. A weakening of resistance due to exposure when being shipped from one point to another often leads to infection by the germ which causes shipping fever.

Symptoms. High temperature, coughing, and watery discharges from the nostrils and eyes are common symptoms.

Prevention and control. Overexposure and drafty means of transportation should be avoided. The cattle should have plenty of water and should not be overcrowded. Infected animals should be separated from the rest of the herd. The cattle should be kept

dry and in a protected place for a few days after shipping. Vaccines are used, but disagreement as to their effectiveness exists among stockmen and veterinarians.

Foot Rot. Foot rot is an infection of the feet of cattle. It usually occurs when cattle are confined for a long period in muddy lots.

Symptoms. Cattle becomes sore-footed, and the infected foot swells and is foul-smelling.

Prevention and control. Keeping lots clean and well-drained and barns free from manure is the best preventive measure. Infected animals may be successfully treated by scraping and cleaning the infected area and disinfecting with lysol or a one per cent bluestone solution. The animal should be kept in a clean, dry stall until cured. In advanced cases a veterinarian should be called.

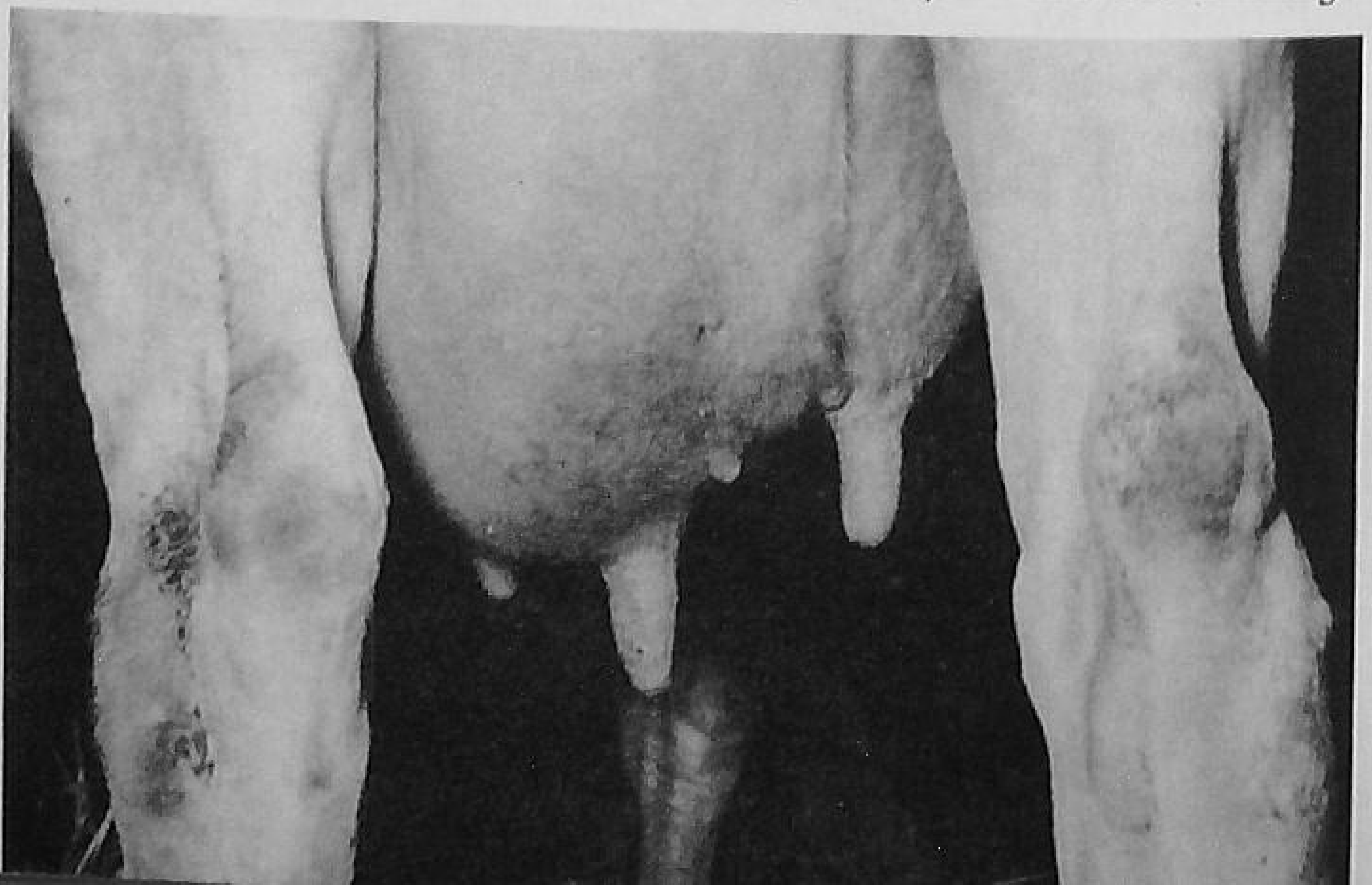
Pink Eye. Pink eye attacks animals of any age but seldom occurs during the winter months.

Symptoms. The first indication of pink eye is a flow of tears and a tendency to keep the eyes closed. There will be a swelling of the eyelids and a general inflammation of the eye.

Prevention and control. Segregating affected animals and calling a veterinarian to treat the infection are the only control measures.

Mastitis. Mastitis is one of the worst diseases of dairy cattle. It generally affects high-producing cows. The disease is caused by a germ which finds its way into the udder, often as a result of an injury.

FIGURE 209. *Cow with mastitis infection. Note the swollen condition of the left hind quarter of the udder. (Bailey photo. Reprinted from* Successful Farming.)



Symptoms. The udder becomes hard and swollen and may be caked; usually only one quarter is involved at a time. Milk production drops and the milk is often stringy or bloody.

Prevention and control. Eliminating sources of udder injury, such as obstacles that may cause bruises or cuts, is important in mastitis prevention. Poorly bedded cement floors are also invitations for udder injuries. Leaving the milking machine on too long may also produce injuries that will be followed by mastitis infection.

Using a strip cup and milking a few streams from each quarter will give the dairyman an opportunity to observe any stringiness or clots in the milk. The Brome-Thymol-Blue test, although not 100 per cent accurate, will give good indication of the presence or absence of mastitis. To conduct the test, place a drop of Brome-Thymol-Blue on a blotter with an eye-dropper, using one drop in a separate spot for each quarter of the udder. Place a few drops of milk on the same spot. If the color changes to a bluish green, mastitis infection may be suspected.

In mild cases successful treatment may be administered by using a prepared aureomycin ointment that comes in a small tube fitted with a spout. The ointment may be injected into the affected quarter through the teat canal. If the animal does not respond to treatment, it should be placed under the care of a veterinarian.

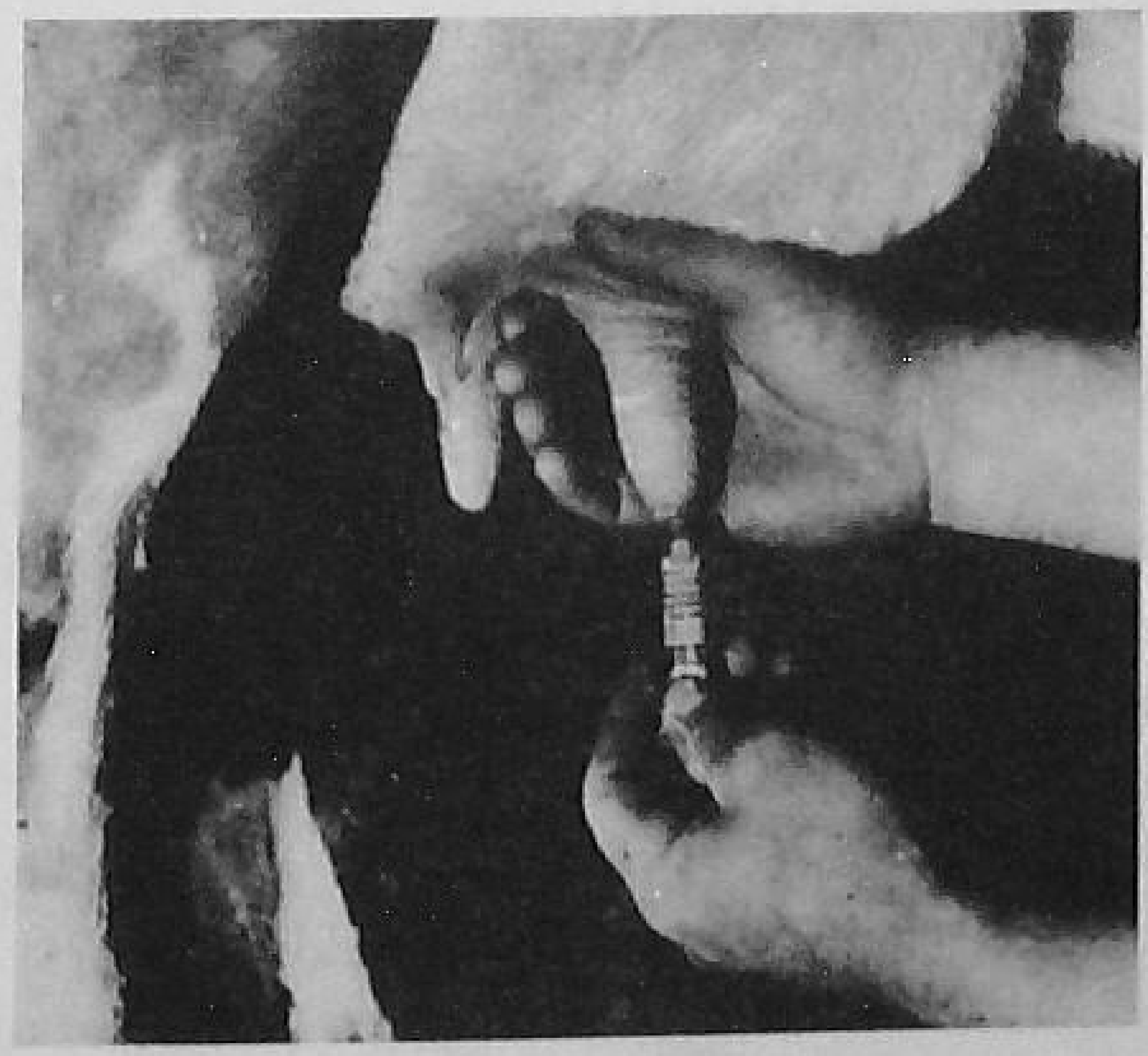


FIGURE 210. *Inserting antibiotics into the udder for mastitis control. (Bailey photo. Reprinted from* Successful Farming.)

FIGURE 211. *Foot and mouth disease.* (*Courtesy U.S.D.A. Bureau of Animal Industry.*)

Foot-and-Mouth Disease. Foot-and-mouth disease is highly infectious. The few outbreaks that have occurred in the United States have been quickly brought under control.

Symptoms. The disease is characterized by blisters that form on the tongue, lips, cheeks, and on the skin around the claws of the feet and on the teats and udder. The blisters cause a heavy flow of saliva that hangs from the lips in strings.

Prevention and control. To control the disease infected animals should be destroyed and the premises disinfected with a lye solution. Recently a vaccine has been developed that is recommended in areas outside of the United States. If foot-and-mouth disease is suspected, federal authorities should be notified, as quick control is essential.

X Disease. X disease, which is usually fatal, has appeared in many areas recently and seems to be spreading.

Symptoms. The disease has a rather slow course, often as long as three months, before death occurs. It generally begins with a loss of weight, and watery discharges from the nose and eyes.

Animals slobber at the mouth, and often sores are found in the mouth.

Prevention and control. No known treatment exists. Close inspection of animals for running eyes, slobbering, and sore mouths should be made before purchasing them.

Warts. Warts on calves are caused by a tiny germ known as a *virus.* The condition spreads from one animal to another by contact.

Symptoms. The warts appear around the neck and head, often near the eyes.

Prevention and control. Wart-infected calves should be placed away from other calves. Painting the warts with iodine once or twice during a two-day period, followed by applications of castor oil, will often eliminate them. A vaccine has been developed which is very effective in controlling warts.

Calf Scours. Germs from filthy stalls and feeding utensils are responsible for calf scours.

Symptoms. Calf scours are characterized by a pasty white scour which usually affects calves under three weeks of age. The animals become weak and lose their appetite.

Prevention and control. The first step in prevention is good management. Calves should be kept in clean, well-bedded stalls, and clean utensils should be used for feeding. One to two quarts

FIGURE 212. *Heifer with warts. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

FIGURE 213. *Typical ringworm infestation. (Bailey photo. Reprinted from* Successful Farming.)

of cultured buttermilk fed daily for three days will often stop the scouring.

Ringworm. Ringworm is a contagious skin disease of cattle that usually affects young stock.

Symptoms. Oval scaly areas around the sides, neck, eyes, and back are signs of ringworm.

Prevention and control. Infected animals should be separated from the rest of the herd and treated by applying phemerol to the areas affected.

NONINFECTIOUS AILMENTS

Milk Fever. Milk fever usually affects high-producing cows soon after calving. The condition is due to a lowering of the calcium in the blood.

Symptoms. The first symptom is staggering and lack of control of the hind legs. Later the animal goes into a coma. When a complete coma has taken place, the head will be drawn back against the chest.

Prevention and control. Milk fever can often be prevented by not milking the cow completely dry for a few days after calving. If milk fever develops, injection of calcium chloride into the veins

in the neck brings about rapid recovery. Unless the operator has had experience, a veterinarian had better be called in if injections are necessary.

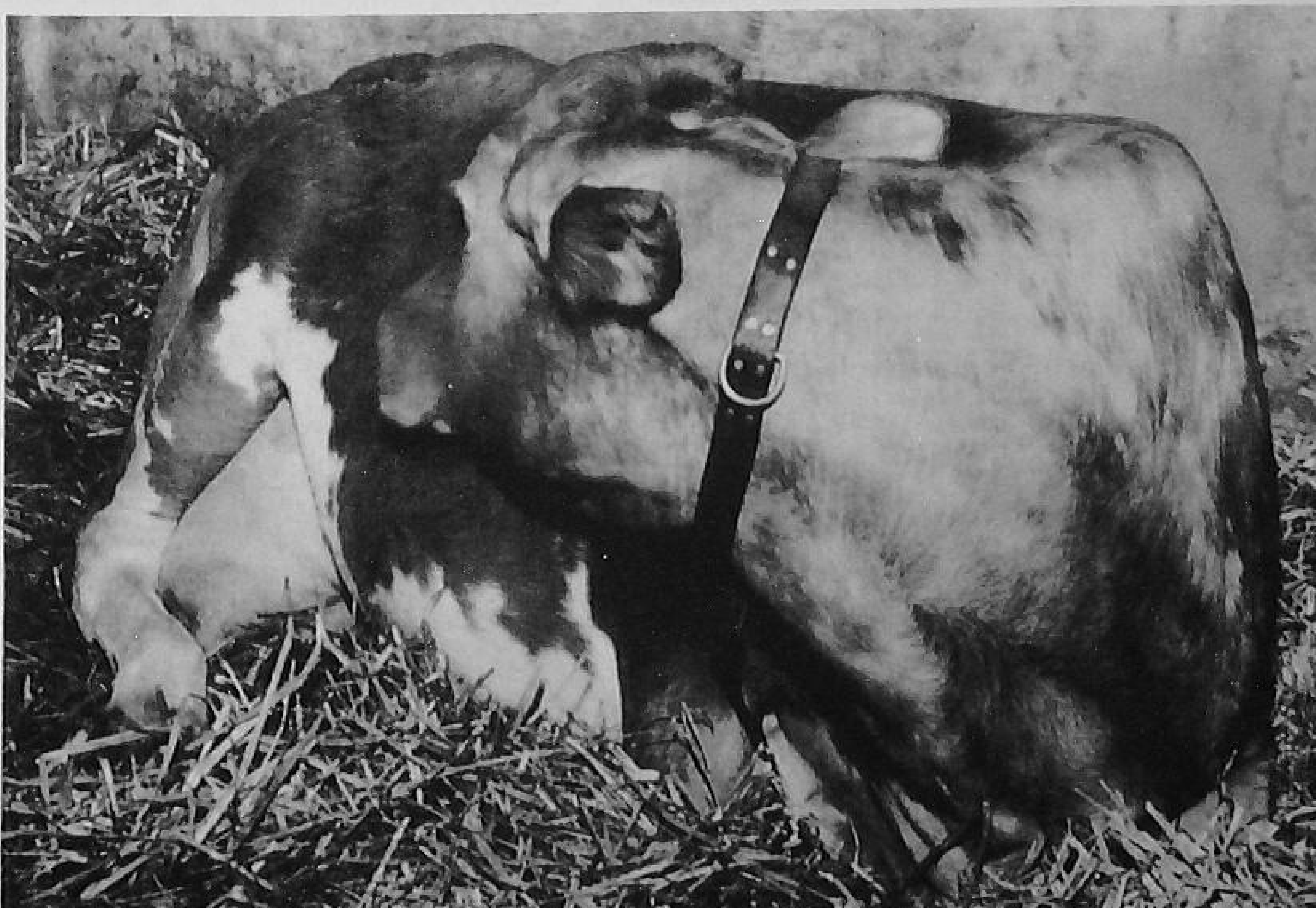
Bloat. Bloat is a condition in which the rumen becomes filled with gas that the animal is unable to expel. The condition may be caused from a growth or other obstruction in the esophagus, but is more often caused by feeds that ferment rapidly in the rumen, causing large amounts of gas to form. Feeding on legume pastures is one of the most common causes of bloat.

Symptoms. The chief symptom is a great distention of the upper left side of the abdomen. Rapid breathing and uneasiness occur. If the animal is not relieved, it will stagger and fall. The pressure becomes great enough to prevent lung action, and suffocation is the final cause of death.

Prevention and control. If the gas pressure is not too great, walking the animal will induce belching and provide relief. Tying a rope or stick in the mouth will often help. If immediate relief is required, a puncture of the rumen becomes necessary. The puncture should be made in the center of a triangle formed by the last rib, the hip bone, and the transverse processes of the backbone.

If cattle pastured on legumes are given access to dry roughages, bloat is less likely to occur.

FIGURE 214. *Cow with milk fever. Note the head drawn back toward the udder. (Reprinted from* Successful Farming.*)*



Ketosis. Ketosis is caused by a shortage of sugar in the body. It usually affects cattle fed for a long period on poor roughage without sufficient concentrates to balance the ration, or dairy cows producing heavily.

Symptoms. Animals affected by ketosis are nervous, lose their appetite, and drop in milk production.

Prevention and control. Prevention depends largely upon proper feeding. Giving affected animals ¼ pound of sodium propionate daily in two doses has given good results, according to veterinarians.

Poisonous Plants. Many plants are poisonous to cattle. A large group of plants will develop what is known as *prussic acid*, especially under conditions that retard growth, such as extreme dry weather or frost. Among this group of plants are sudan grass, Johnson grass, plum leaves, chokecherry leaves, and other plants of the sorghum family. Prussic acid is very poisonous and often proves fatal within a few minutes after the consumption of the plant containing it.

Sweet clover hay or silage not properly preserved often proves toxic to cattle. Certain weeds, such as snakeroot, larkspur, loco weed, water hemlock, milkweed, and cocklebur, will poison cattle if consumed in large enough quantities.

SUMMARY

The first steps in the prevention of disease and parasite infestation of the herd are sanitation, clean, well-drained lots, clean and regularly disinfected buildings, and precautions against purchase of sick animals or animals exposed to infections.

The most effective control measure for external parasites, except screw worms and mites, is the use of proper sprays and dusts. Rotenone dust is effective for the control of grubs and lice, whereas DDT or methoxychlor will control various kinds of flies as well as lice. Methoxychlor is recommended for dairy cattle. Mites may be controlled by a lime-sulphur dip or a lindane solution. Applying Smear EQ 335 on all wounds in a screw-worm-infested area will prevent the worms from infecting open wounds. The common stomach worm may be controlled with phenothiazine.

Brucellosis is best eradicated by a testing and vaccinating program, whereas tuberculosis is controlled by testing and eliminating reactors.

Blackleg and anthrax can be prevented by vaccination.

Foot rot may be successfully treated by using a disinfectant like lysol or bluestone. If it is an advanced case, a veterinarian should be called.

Mastitis usually affects dairy cattle, and can often be detected by the Brome-Thymol-Blue test. Aureomycin injected into the udder through the teat canal will help in many cases.

Warts may be treated with iodine, followed by applications of castor oil. A special vaccine is also effective. Ringworms are best treated by applying phemerol to the affected area.

Milk fever is a condition due to a lack of calcium. Injections of calcium chloride into the veins will usually correct the condition.

Bloat is caused by the formation of gas which the animal cannot expel. It is often caused by certain feeds, such as young legume pasture. Treatment that will induce belching should be used. If such methods fail, making a slit through the animal's side into the rumen will allow the gas to escape.

Ketosis is a condition arising from a sugar deficiency; a proper ration is the best preventive measure.

Poisonous plants cause death losses among cattle. Knowing the poisonous plants and preventing their consumption is the only prevention.

QUESTIONS

1. List the steps of a good disease and parasite prevention program.
2. Give three control programs for brucellosis and explain the circumstances under which you would recommend each.
3. Name the common external parasites of cattle and give the methods of control for each.
4. How would you prevent and control common stomach worms?
5. What diseases can be successfully controlled by vaccines?
6. Give the home treatments for warts and ringworms.

REFERENCES

Gunderson, Harold, *Controlling Livestock Pests,* Ames, Iowa, Agricultural Extension Service, Pamphlet 132.

Petersen, W. E., *Dairy Science,* J. B. Lippincott Company, Philadelphia, 1950.

U. S. Department of Agriculture, *Insects,* The Year Book of Agriculture, 1952.

Profitable Sheep Production

< 23 >

The Sheep Production Industry

Sheep are raised primarily for meat and wool. Lamb and mutton have been less popular than pork or beef in the American diet. Only about 10 per cent as much lamb and mutton are consumed as beef and pork. The sale of lambs for slaughter purposes constitutes the principal source of income. However, the sale of wool is important as a secondary source of profit from the sheep industry. Although sheep are raised in every state in the union and represent one of the major livestock enterprises of the United States, the greatest numbers are found in the western and midwestern states. The leading states in numbers of sheep on farms and ranches are: Texas, Wyoming, Montana, California, New Mexico, Utah, Colorado, Missouri, Idaho, and Ohio.

OPPORTUNITIES IN SHEEP PRODUCTION

Opportunities in sheep production are numerous and varied. The sheep population is declining in the United States. In 1942 we had 50 million stock sheep, whereas in 1952 we had only 28 million. There are several phases of the sheep business. Almost any farm and many range areas offer opportunities for profitable sheep production. Sheep are unexcelled in their ability to consume roughages, which makes them a favorite type of livestock on many farms that have large amounts of pasture land. Small flocks of sheep in the grain-producing areas will utilize much waste feed, gleaning cornfields, house and barnyards, windbreaks, and orchard areas, whereas other types of livestock would do damage or would be otherwise undesirable. Sheep eat most plants, cropping them close to the ground, which results in the destruction of many weeds.

Sheep give rather quick returns. Lambs may be marketed from three to six months after birth, and a crop of wool is harvested once a year. Farms that are low in fertility may be improved con-

FIGURE 215. *A farm flock of Dorsets. (Courtesy Continental Dorset Club of America.)*

siderably with sheep. Since sheep are heavy consumers of roughages, such farms may be seeded largely to legumes and grasses. Lambs are the only livestock that can produce a prime product on grass alone. Sheep do not require warm housing, except when lambing during cold weather; therefore, they may be allowed to run over the land most of the year. The manure is spread as it is made, eliminating the labor of hauling it out onto the field. Manure that is spread directly upon the land by the animals is usually richer in plant food than is manure accumulated in yards and sheds where it may lose much of its plant food from washing and leaching.

CLASSES OF SHEEP PRODUCERS

Sheep producers may be divided into four general classes: (1) the rancher, (2) the raiser of farm flocks (in the east and midwest), (3) the lamb feeder, and (4) the producer of purebreds. Some individuals combine two or more of the above classes of production.

Sheep Production on the Range. About 65 to 70 per cent of the sheep population is found in the western range area. Large flocks ranging from 1000 head of ewes and up are common on many western ranches. The kind and amount of grass available is important in determining the methods of production and market-

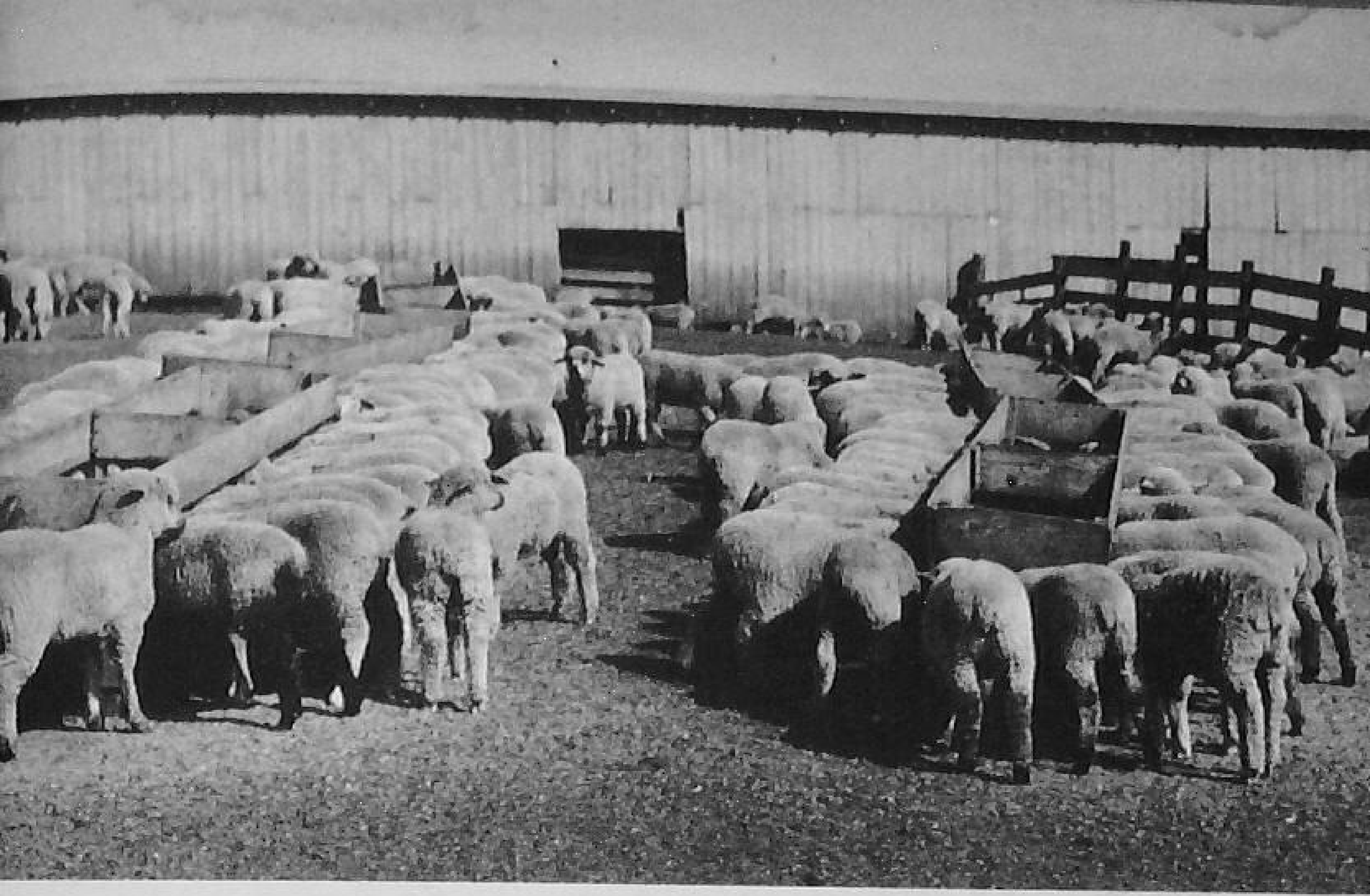


FIGURE 216. *A group of feeder lambs in the feed lot. (Courtesy Rath Packing Company.)*

ing. In the northern plains region where the amount and quality of feed are usually good, most of the lambs are sold for slaughter at weaning time as milk fat lambs. Where grazing conditions are less favorable, many lambs are sold into the grain-producing areas for fattening.

The Farm Flocks. Throughout the midwest and the eastern agricultural areas many farm flocks of sheep ranging from 10 to 300 ewes are found. On many of these farms sheep constitute a very minor enterprise, whereas on others they are the principal source of income. The farmer usually markets his lambs for slaughter purposes.

The Lamb Feeder. Lamb feeders are generally located in the grain-producing areas. They buy feeder lambs, usually from the range, in late summer or fall. Lamb feeders depend upon their profits from the increase in value per 100 pounds as a result of fattening, known as *margin*, and from the value of the gain over the feed cost.

The Breeder. The breeder usually produces purebred animals. His principal markets are other breeders, ranchers, and farm flock owners who buy rams for breeding and ewes to improve their flocks. The breeder requires more skill than do other types of producers because he needs to know the demands of consumers and flock owners, in addition to understanding feeding and man-

agement. The sheep industry depends largely upon the breeders for improvement in type, growing ability, and quality of fleece. Purebred sheep breeders are located wherever sheep are produced. The feeding of large quantities of grain is not essential in the purebred industry, except where the breeder is fitting animals for show purposes.

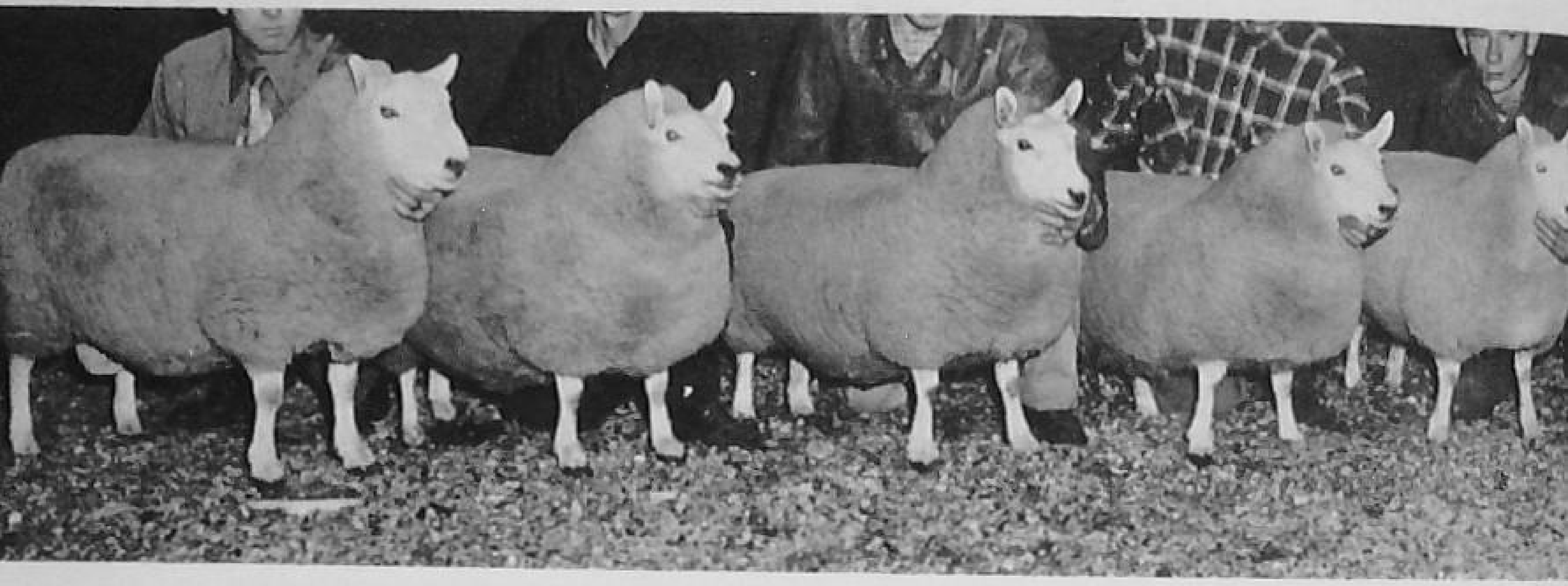


FIGURE 217. *A portion of an excellent purebred flock of Cheviots. (Abernathy photo. Courtesy American Cheviot Sheep Society, Inc.)*

Combination Enterprises. Many sheepmen prefer to combine two or more forms of the sheep enterprises. The most common combination system consists of a purebred flock where the offspring are sold largely for breeding purposes, and a commercial flock where lambs are produced and fattened for slaughter. Many purebred breeders start with a small flock of registered animals, depending upon their commercial flock to provide the profits until they can establish the purebred enterprise on a sufficient scale to provide the expected income.

SUMMARY

Sheep are produced to supply meat and wool. Lamb and mutton are not as popular as beef and pork on the American table, representing only about 10 per cent of the amount of pork and beef consumed. Although wool is an important source of income, it is secondary to the sale of lambs.

Sheep raising offers many opportunities for the livestock man. It has the advantage of quick returns from the lamb crop and provides two sources of income, lambs and wool. Sheep are unexcelled as livestock for farms low in fertility. They are heavy

consumers of roughages and fit in well with farms that need to be improved.

Most of the sheep are produced in the western range areas and on midwestern farms. The rancher depends upon the sale of milk fat lambs, or feeder lambs for his main source of income, whereas the midwest and eastern farmers often buy and fatten lambs. Many farm flocks ranging from a few head up to 300 or 400 ewes are to be found. Most of these lambs are fattened and sold for slaughter.

The purebred industry offers an opportunity for skilled sheep men, who have the required capital, to become established in the business.

Many producers combine two or more types of sheep production, such as purebred flocks and commercial flocks.

QUESTIONS

1. What opportunities does the sheep industry offer in your community?
2. Which class of sheep producers is most common in your community? Your state?
3. Why are sheep especially adapted to farms low in fertility?
4. What advantages does the sheep producer have over the cattle producer?

REFERENCES

Horlacker, Levi Jackson, *Sheep*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Peterson, J. C., *Sheep and Wool Production*, The Peterson Sheep Company, Spencer, Iowa, 1953.

< 24 >

The Selection of Breeding and Feeding Stock

When entering the sheep business, the prospective shepherd has many decisions to make. He must not only decide which phase of the industry to enter but must also determine which class and breed of sheep to produce. No other kind of farm livestock has so many breeds—approximately two hundred. In addition to the breeds, sheep are divided into classes according to general type and characteristics. There are six classes of sheep. The classes will be discussed in detail in the following pages, but only the more important breeds in the United States will be given consideration.

CLASSES OF SHEEP

Sheep are classified according to the type of wool they produce. The classes are: (1) fine-wool type, (2) medium-wool type, (3) long-wool type, (4) crossbred-wool type, (5) carpet-wool type, and (6) fur sheep.

Fine-wool Type. The fine-wool breeds consist of those breeds that produce a fine wavy fiber of wool. The fleece is dense and contains a large amount of yolk or oil. The fine-wool breeds produce a heavy fleece of good quality. These breeds have been developed primarily for their wool production. Although the lambs are sold for slaughter and produce fair carcasses, the primary reason for their production is wool. The fine-wool breeds possess a strong banding instinct and the ability to graze on poor-quality range, which makes them especially adaptable for many western range areas.

Medium-wool Type. The medium-wool breeds are kept primarily for meat production. They are called medium-wool breeds because their fleece is medium in fineness and length. The medium-

wool breeds are low-set, blocky, and compact in type. They are generally considered the best for meat qualities.

Long-wool Type. The long-wool sheep are the largest of the breeds and are so-called because of the long wool fibers they produce. Fibers twelve inches long are not uncommon for the long-wool breeds. The wool is coarser than that of either the medium- or fine-wool sheep. The fleeces are heavier than are those from the medium-wool breeds.

Crossbred-wool Type. The crossbred-wool breeds resulted from an infusion of long-wool and fine-wool breeds. As a result of selection many recent breeds have been established from these crosses. The general purpose of these crosses is to improve the meat qualities of the fine-wool breeds but to retain the banding instinct and grazing ability of the fine-wool sheep. Breeds resulting from these crosses have become popular in many areas, especially in the western range country. The crossbred breeds are usually classified as medium-wool sheep because they produce a very similar type of wool.

Carpet-wool Type. The manufacturing of carpets and rugs demands a long, coarse, tough fleece. Most of the carpet wool is imported because very few sheep of the carpet-wool type are produced in this country.

Fur Sheep. A comparatively new sheep industry is developing in the United States. This is the production of lamb pelts for furs. Fur production requires a certain kind of pelt which is produced by fur-type sheep. The pelts are taken from the lambs when they are only a few days old and are known as Persian lamb.

FINE-WOOL BREEDS

Merinos. There are three types of Merino sheep, all originating from the same parent stock. The types are known as the A, B, and C or Delaine Merinos. The A-type sheep are extremely wrinkled from the head to the dock, making them hard to shear. The A-type Merino has lost its popularity in the United States and is almost extinct in this country.

The B type have less wrinkles, confined mostly to the neck, whereas the C type, or Delaine Merinos, are comparatively smooth. The Delaine Merinos are the largest of the breed, with mature rams weighing from 160 to 190 pounds and ewes ranging from

110 to 150 pounds. The Delaines have the best mutton qualities of the Merinos. The highest quality of fine-wool fleeces are produced by Delaine Merinos.

TABLE 38

CLASSES AND COMMON BREEDS OF SHEEP

Fine-wool Type	*Medium-wool Type*	*Long-wool Type*	*Crossbred-wool Type*	*Carpet-wool Type*	*Fur Type*
American Merino	Cheviot	Cotswold	Columbia	Black-faced-Highland	Karakul
Delaine Merino	Dorset	Leicester	Corriedale		
Rambouillet	Hampshire	Lincoln	Panama		
	Montadale	Romney	Romeldale		
	Oxford		Targhee		
	Shropshire				
	Southdown				
	Suffolk				
	Tunis				

In the trade the smooth-bodied Merinos are designated as Delaines, and the wrinkled type as American Merinos. All purebred Merinos may be registered in the same breed association because they are similar in type and ancestry.

The Merinos originated in Spain, the first importation into the United States being made in 1793. Because of their banding instinct they are easy to herd, enabling one shepherd to control large numbers of sheep. They are good grazers, able to forage over large areas of poor grasslands. Where grazing conditions are not favorable for the production of grass-fat lambs, the wool-producing ability of the Merino has made them a favorite.

The Merino is a white-faced sheep with white feet. Most rams have horns, whereas the ewes are hornless. Most of the head and legs are covered by wool. Merinos have long been bred for wool production and do not carry the straight lines and compactness of the mutton breed; they produce an average lamb crop of about

FIGURE 218. *Typical Merino ram. (Courtesy Iowa Sheep Breeders' Association.)*

110 per cent, which means that only one ewe in ten will have more than a single lamb. Merinos are extremely hardy, being able to survive under poor grazing, and adverse weather, conditions. The ewes live and produce longer than most any other breed.

Rambouillet. The Rambouillet is a descendant of the old Spanish Merino, and was developed as a breed in France. Although Rambouillets are close relatives of the Merino, they have been bred to produce a better carcass. Rambouillets cannot be compared with the best mutton breeds, but they do make fair fat lambs and produce an excellent fine-wool fleece. The rams may have horns or be hornless. The ewes are hornless. Rambouillets have large heads with white hair around the nose and ears. The body is not as smooth as that of the mutton type, but the lines are fairly straight, and they carry considerable depth. The rams weigh about 250 pounds when mature and the ewes about 150 pounds. The fleece is heavy, close, and compact, covering most of the body, including face and legs.

There are two types of Rambouillets, determined by the number of skin folds. The B type are the more wrinkled variety, whereas the C type are comparatively smooth.

The Rambouillets are good mothers, quite prolific, and are un-

FIGURE 219. *Rambouillet ram. (Courtesy American Rambouillet Sheep Breeders Association.)*

FIGURE 220. *Cheviot ram. (Abernathy photo. Courtesy American Cheviot Sheep Society, Inc.)*

equalled for range qualities. A very large percentage of the range sheep carry some Rambouillet blood. When Rambouillets are crossed on medium- or long-wool breeds, the resulting lambs are good feeders and will produce top-quality fat lambs.

MEDIUM-WOOL BREEDS

Cheviot. The Cheviot was developed primarily in Scotland. It is a beautiful sheep with erect ears, a clean white face, and white

FIGURE 221. *Dorset ram. (Courtesy Continental Dorset Club of America.)*

legs. The face and legs are covered with short white hair. The nose, lips, and feet are black.

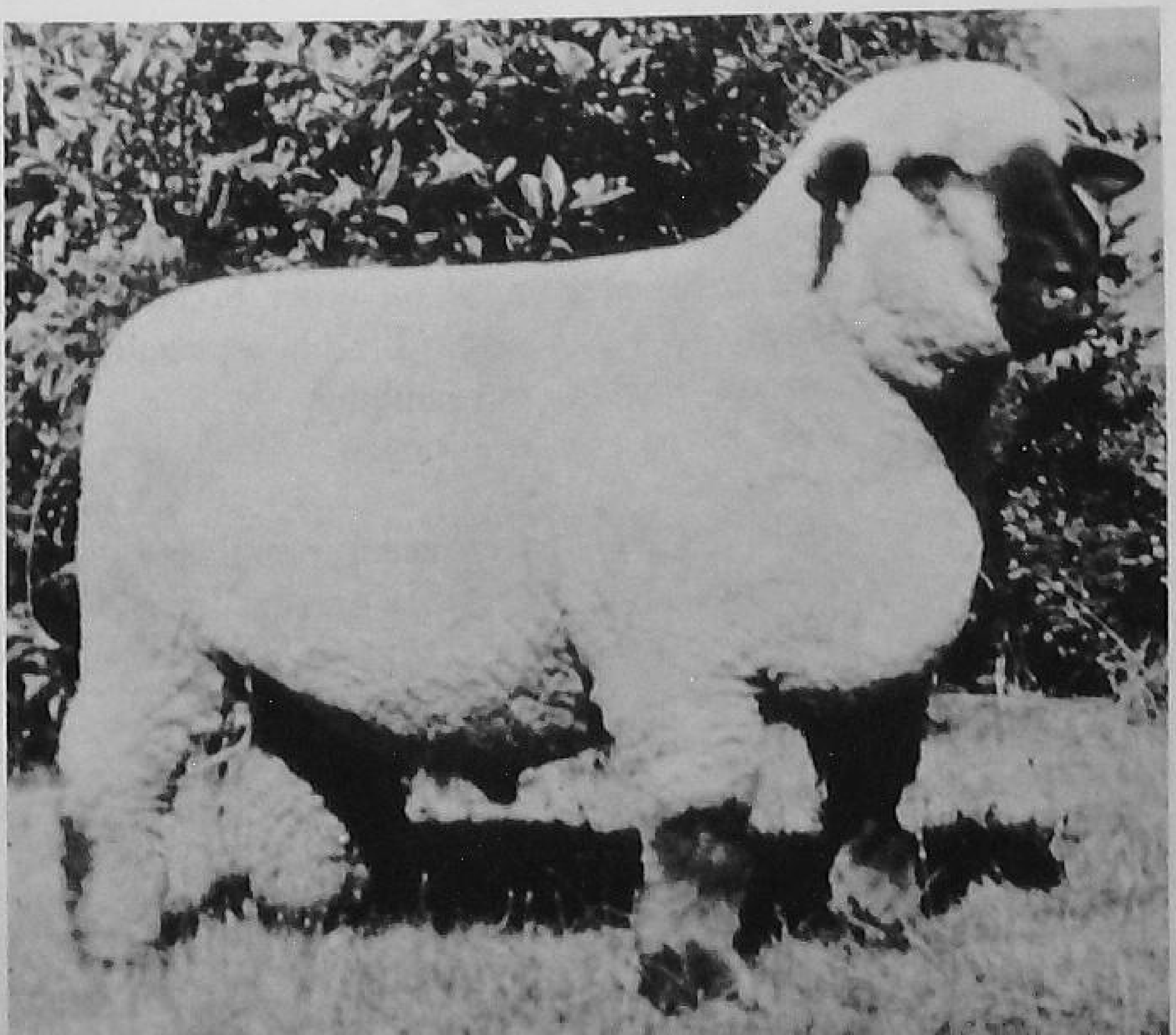
The breed is small, with rams weighing from about 175 pounds and ewes from about 125 pounds. They are blocky, compact, and well-developed over the back, loin, and leg of mutton. The fleece is light, averaging from 6 to 8 pounds, but it contains a small amount of yolk and is light-shrinking. The Cheviot ewes are good mothers and quite prolific, averaging about a 125 per cent lamb crop.

Dorset. Both ewes and rams of the Dorset breed have horns. The ewes will breed during warm weather or out of season. Since most sheep breeds come in heat only during the cooler weather, Dorset are popular when fall lambs are desired.

The Dorsets are native to England. They are medium-sized, with rams weighing from about 200 to 250 pounds and ewes from about 150 to 175 pounds. The ewes are prolific, averaging near 150 per cent lamb crop. Dorset will shear from an 8- to 10-pound fleece.

Hampshire. The Hampshires are native to England. They have become very popular in the United States as a mutton-type breed. The Hampshires have most of the qualities desired in mutton sheep

FIGURE 222. *Hampshire ram. (Courtesy American Hampshire Sheep Association.)*



and are fast-growing. Hampshires are large with rams weighing from about 250 pounds and ewes from about 180 pounds. The ewes are prolific and good mothers.

The face, ears, and legs of Hampshires are a dark brown to black in color. They shear a fleece averaging around 8 pounds in weight.

Montadale. The Montadale breed was started by E. H. Mattingly of St. Louis, Missouri, in 1913. Columbia and Cheviot were used in the foundation breeding. The Montadale is a good mutton type, and the wool clip will average from about 10 to 12 pounds.

Oxford. The Oxford is native to England and is the largest of the medium-wool breeds. Mature rams will weigh 300 pounds or more and ewes from 200 to 250 pounds. The head and ears are small compared to the body. The Oxford is hardy and can stand long, cold winters. The ewes are fairly prolific. Oxfords shear a heavy fleece for a medium-wool breed averaging about 12 pounds.

Shropshire. The Shropshires originated in England. They are one of the smaller breeds. Rams weigh about 200 pounds and ewes from 135 to 150 pounds. The typical Shropshire has wool covering all of the body from the feet to the nose. The breed has been widely used in crossing. The ewes are prolific and fair milkers. Shropshires produce a good weight fleece for small sheep. The fleece will average about 9 pounds in weight.

Southdown. The Southdown is a small sheep. Rams weigh about 175 pounds and ewes about 125 pounds. The head is broad with a wool cap that comes just below the eyes. The face is mouse-colored.

Southdowns are unequalled for the production of quality lambs for market. The rams are often crossed on other breeds to improve the mutton quality of the lambs. This is especially true with Dorset ewes that are bred for fall lambing.

Southdown ewes are average in prolificacy. They are light milkers but good mothers.

Suffolk. The Suffolk has enjoyed a recent popularity in the United States that is unequalled by any other breed. It originated in England and, until the last few years, was not popular in this country.

The Suffolk is distinguished by its black face, legs, and ears. In size it compares favorably with the Hampshire and is excellent in mutton type. The ewes are very prolific and good mothers.

FIGURE 223. *Montadale ram. (Courtesy Iowa Sheep Breeders' Association.)*

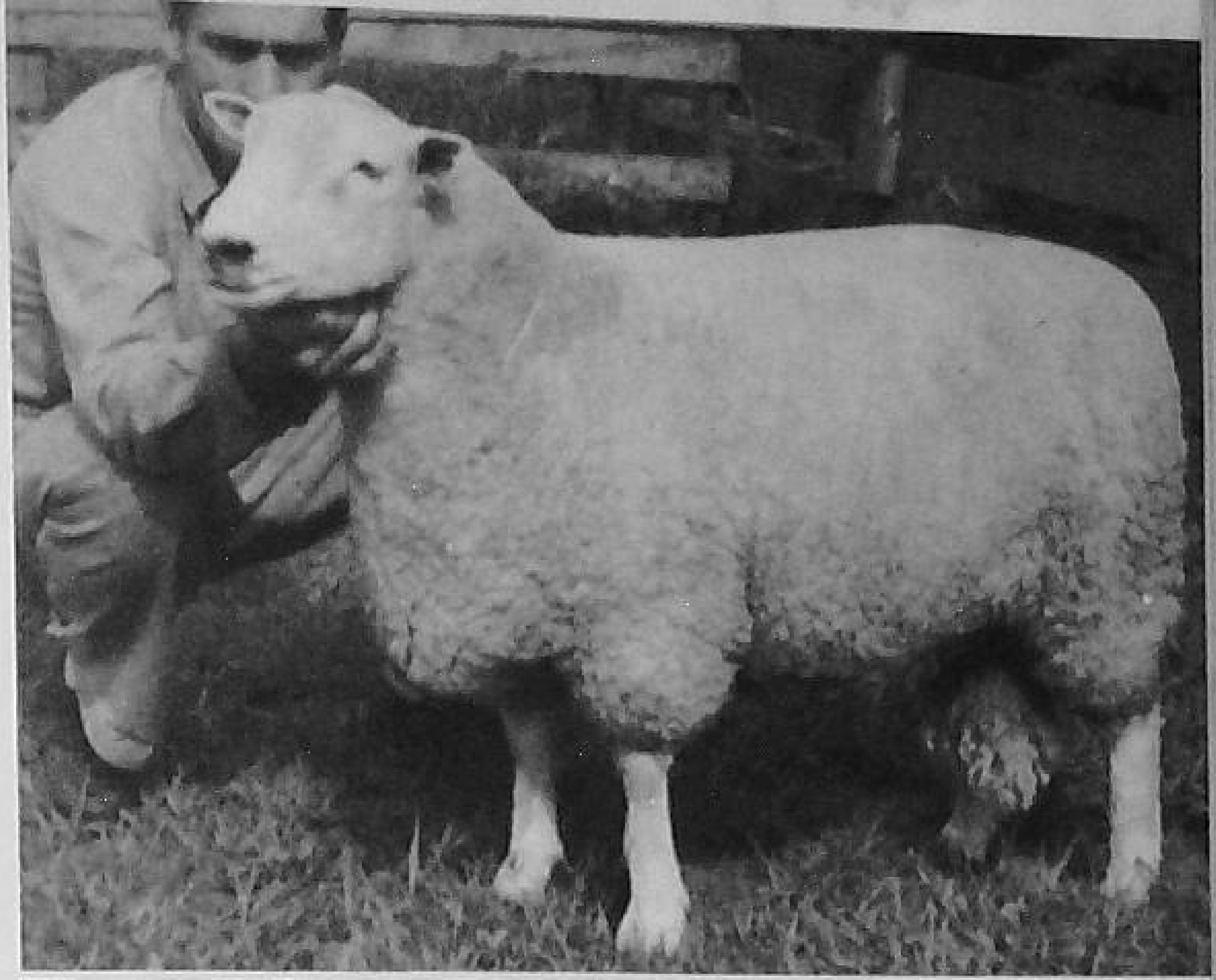


FIGURE 224. *Oxford ram. (Abernathy photo. Courtesy American Oxford Down Record Association.)*

FIGURE 225. *Shropshire ram. (Courtesy Iowa Sheep Breeders' Association.)*

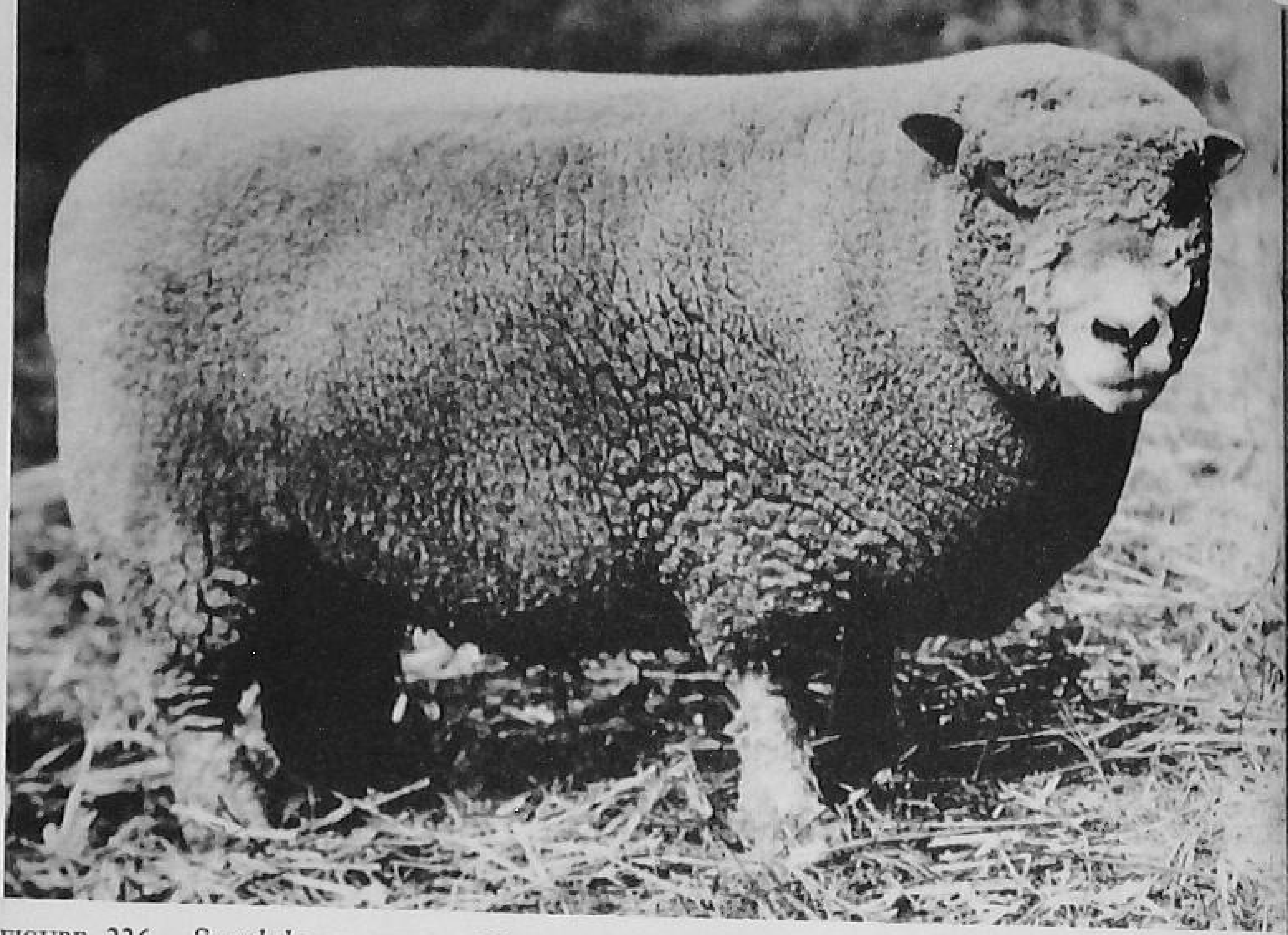
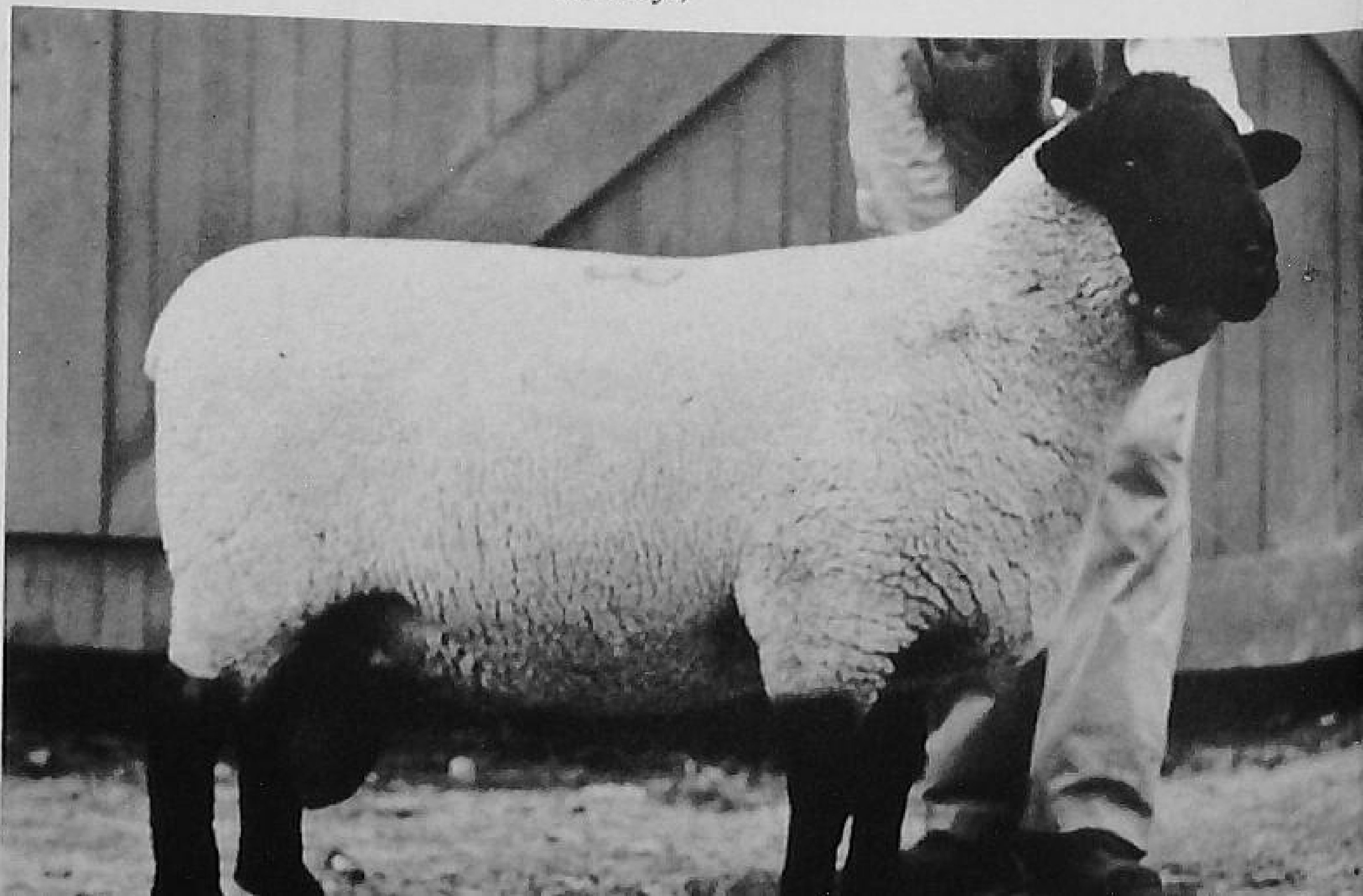


FIGURE 226. *Southdown ram. (Courtesy American Southdown Breeders' Association.)*

Tunis. The Tunis has never been very popular in the United States. The breed originated in Asia and is probably one of the oldest breeds of sheep. The Tunis is a small breed. The rams weigh about 150 pounds and the ewes about 110 pounds. The face, ears, and legs are a reddish brown. The mutton qualities of

FIGURE 227. *Suffolk ram. (Saxton photo. Courtesy American Suffolk Sheep Society.)*



the breed are fair, and the fleece is light in weight. Like the Dorset it will breed almost any time and is advantageous where fall lambs are desired.

LONG-WOOL BREEDS

Cotswold. The Cotswold is an English breed of long-wool sheep. The wool hangs in curls, with a tuft of wool hanging from the forehead down over the eyes. The wool is coarse and the fibers are long. Cotswold are large sheep, with rams weighing 300 pounds and ewes up to 225 pounds.

Except in crosses on other breeds, the Cotswold is not popular as a meat producer owing to the fattiness of the meat. The ewes are prolific and good milkers.

Leicester. There are two types of Leicester sheep, the English and the Border. Leicesters are medium in size with clean faces and legs. The ewes are not very prolific. Leicesters have been used mainly for crossing purposes in the United States. The body form and wool are typical of the long-wool breeds.

Lincoln. The Lincoln is a large sheep with a broad head and large thick ears. It is very rugged and heavily fleshed. The wool is long and of good weight and quality. The ewes will produce from 12 to 16 pounds of wool annually. The ewes are fairly

FIGURE 228. *Lincoln ewe. (Abernathy photo. Courtesy National Lincoln Sheep Breeders' Association.)*

prolific, but are not recognized for their milking ability. The Lincoln has been used successfully in crosses, especially for range sheep.

Romney. The Romney is one of the smallest of the long-wool breeds. It is hardy and crosses well on Rambouillets and other breeds for market lamb production. The ewes are average in prolificacy, producing about 125 per cent lamb crop.

FIGURE 229. *Columbia ewe. (Courtesy Columbia Sheep Breeders Association of America.)*

FIGURE 230. *Corriedale ram. (Abernathy photo. Courtesy American Corriedale Association, Inc.)*

CROSSBRED-WOOL BREEDS

Columbia. The Columbia is an American breed developed by the Bureau of Animal Industry. The foundation of the breed consisted of a cross of Lincoln rams on Rambouillet ewes. It produces a good market lamb and wool clip. The Columbia has become very popular in the better range areas. The ewes are good milkers and are prolific. The breed is hardy and fulfills the range need for a breed that will produce a good market lamb and wool clip.

The Columbia is open-faced. The face and legs are covered with white hair. They are larger than average in size, with rams weighing from about 275 pounds and ewes up to 190 pounds.

Corriedale. The Corriedale was developed in New Zealand by crossing Lincoln and Leicester rams on Merino ewes. By a process of inbreeding and selection, the present-day Corriedale type was established. The Corriedale is not a large sheep. The rams weigh from 190 to 250 pounds and the ewes about 175 pounds. The Corriedale breed does a good job of combining both wool and meat production. The lambs are quite compact in form, and the ewes will shear from a 10- to 12-pound fleece. The breed herds well and has a wide popularity for both range and farm flock production.

Panama. The Panama is an American breed, the parent stock being Rambouillet rams crossed on Lincoln ewes. This is the same foundation stock as was used in developing the Columbia. As a result, Panama and Columbia are very similar in type.

Romeldale. The Romeldale is a new breed developed in California. The foundation stock was Romney rams crossed on Rambouillet ewes. As a result of inbreeding and rigid selection, the Romeldale is producing a fleece ranging from 10 to 15 pounds, and is a compact, good-quality meat animal.

Targhee. The Targhee was developed by the United States Sheep Experiment Station. The foundation stock consisted of Rambouillets, Corriedales, and Lincolns. The breed is white-faced, shears from an 11- to 12-pound fleece, and produces a rapid-growing, compact, mutton-type lamb. This breed is the only one that produces a fleece grading one-half blood.

CARPET-WOOL BREEDS

Black-faced Highland. The Black-faced Highland is typical of

the carpet-wool type. The breed is of very minor importance in this country. Black-faced Highlands are of Scottish origin. Both sexes have horns. The face and legs are black, and the wool is long and coarse, resembling hair rather than wool.

THE FUR SHEEP

Karakul. The Karakul is a native of Bokhara (U.S.S.R.). It is produced in the United States because of the suitability of the lamb pelts for furs. The breed is of poor-mutton quality, and the fleece of mature animals is low in value. The face and legs are dark in color, and the rams have horns.

SELECTING A BREED

In selecting a breed of sheep, a number of factors that will affect the ability of the breed to produce efficiently and profitably must be considered. The more important considerations are: (1) environmental conditions under which the animals will be produced, (2) market price and demand for the principal product to be produced, (3) cost and availability of breeding stock, and (4) personal likes.

Environmental Conditions. It has been pointed out that certain breeds have the ability to forage and survive over range areas that have sparse vegetation, producing a wool clip and a lamb where other breeds would fail. Also some breeds have what is known as a *banding instinct* or the tendency to graze in close, compact groups. When large bands of sheep are grazed over unfenced areas and where predatory animals are prevalent, it is important that the sheep maintain a close formation. One shepherd is usually charged with the care of the flock. He has the help of well-trained sheep dogs, but his task would be impossible under many conditions with breeds that tended to spread out as they grazed. Certain breeds have a wool-covering over the face. Some individuals of these breeds are subject to wool blindness, especially when snow and ice get into the fleece. Unless individual attention is given each animal, such breeds may not be a wise choice.

In areas where feed is plentiful and where the flock may graze on fenced pastures, mutton or fat lamb production will probably be the best source of income. The medium-wool or crossbred-wool breeds generally produce a better quality of lamb than do either the fine-wool or long-wool breeds.

FIGURE 231. *Karakul lamb. (Courtesy Don Collinson.)*

Many breeders of fur sheep have found the enterprise profitable. The numbers of fur sheep are not large in the United States, and most breeders of this type have been selling surplus animals for breeding, rather than for fur, purposes.

Market Price and Demand. Market outlets and the price paid for the product are a consideration in selecting a breed. The breeder of purebreds must rely upon commercial producers and other breeders for his sales. The number of breeding animals in proportion to the demand for such animals determines to a large extent the demand and price a breeder will receive for his stock.

Immediate and future outlook for wool prices is an important factor not only in the selection of a breed but of the type of sheep to produce. Breeds that are primarily adapted for wool production may not be a wise choice in the face of surplus wool, unless environmental conditions make it necessary to select this type.

If the producer lives close to a market for small fat lambs, known as *bothouse lambs*, he may find one of the small, fast-maturing, medium-wool breeds a wise selection.

Cost and Availability of Breeding Stock. The commercial pro-

ducer must depend upon the purebred breeder for improved breeding animals, especially rams. How far he will have to go to get these animals and what they will cost him on the farm or ranch are two questions he must answer before choosing a breed. It is usually cheaper and easier to find breeding animals if the breed is common to the community. However, if a new breed has been developed or if the establishment of another breed in a community will be a decided improvement, the first producers to get a start in the breed will probably harvest some handsome profits. Such breeders will have a good demand for breeding stock until a general change-over of breeds has been accomplished in the community.

Personal Likes. Success depends largely upon one's interest in his work. To choose a breed that does not appeal to the producer makes it difficult to develop the interest necessary for success. The breeder of sheep is fortunate in having several breeds that have similar economical values but differ considerably in appearance from which to choose. For instance, the Cheviot and Southdown are of about the same general type. Both are small, compact, excellent mutton-type breeds. Their commercial values are about the same, and they do well under the same conditions. In appearance the two breeds differ. The Cheviot is clean-faced, and the legs are free from wool, whereas the Southdown has wool over the face and legs. Each type of sheep presents breeds similar in form and economic value but different in other characteristics.

SELECTING FOUNDATION STOCK

Having decided upon the breed of sheep to raise, the next problem that confronts the breeder is that of selecting foundation stock. Although some breeds are considered superior for the amount and quality of their wool and other breeds for mutton qualities, the general type desired is very much the same, regardless of breed.

The breeder of fine-wool sheep may be especially concerned about the quantity and quality of the wool they produce, but he also depends upon the sale of lambs for a good share of his income. The meat qualities of the lambs determine largely the price they will bring, either as feeder or slaughter lambs. It is also true that the breeder of mutton sheep depends on the wool clip as a secondary source of income. His chief concern is the mutton qualities of the animals, but if a heavy fleece of good quality is produced, his chances of a profit from the enterprise are considerably better.

Breeders then may differ in points of emphasis, but in general they are looking for about the same conformation.

Each breed has its own characteristics that are desirable and in many cases essential, for registration, but are not important from a production standpoint. Color, wooled or clean legs, and the presence or absence of horns are examples of breed characteristics. Breeders of purebreds are more concerned about individual breed characteristics than are commercial producers. The breed associations will furnish the necessary information on the various breeds.

Selection Based on Body Conformation. Sheep, unlike other livestock, must be judged largely with the hands, rather than the eyes, because of the wool covering. Wool may cover up many defects that cannot be seen. Therefore, going over the animal with the hands from the neck to the leg of mutton enables the trained judge to uncover any possible defects.

FIGURE 232. *Three views of two sheep. The one on the right is the most desirable in each picture. (Courtesy Michigan State College.)*

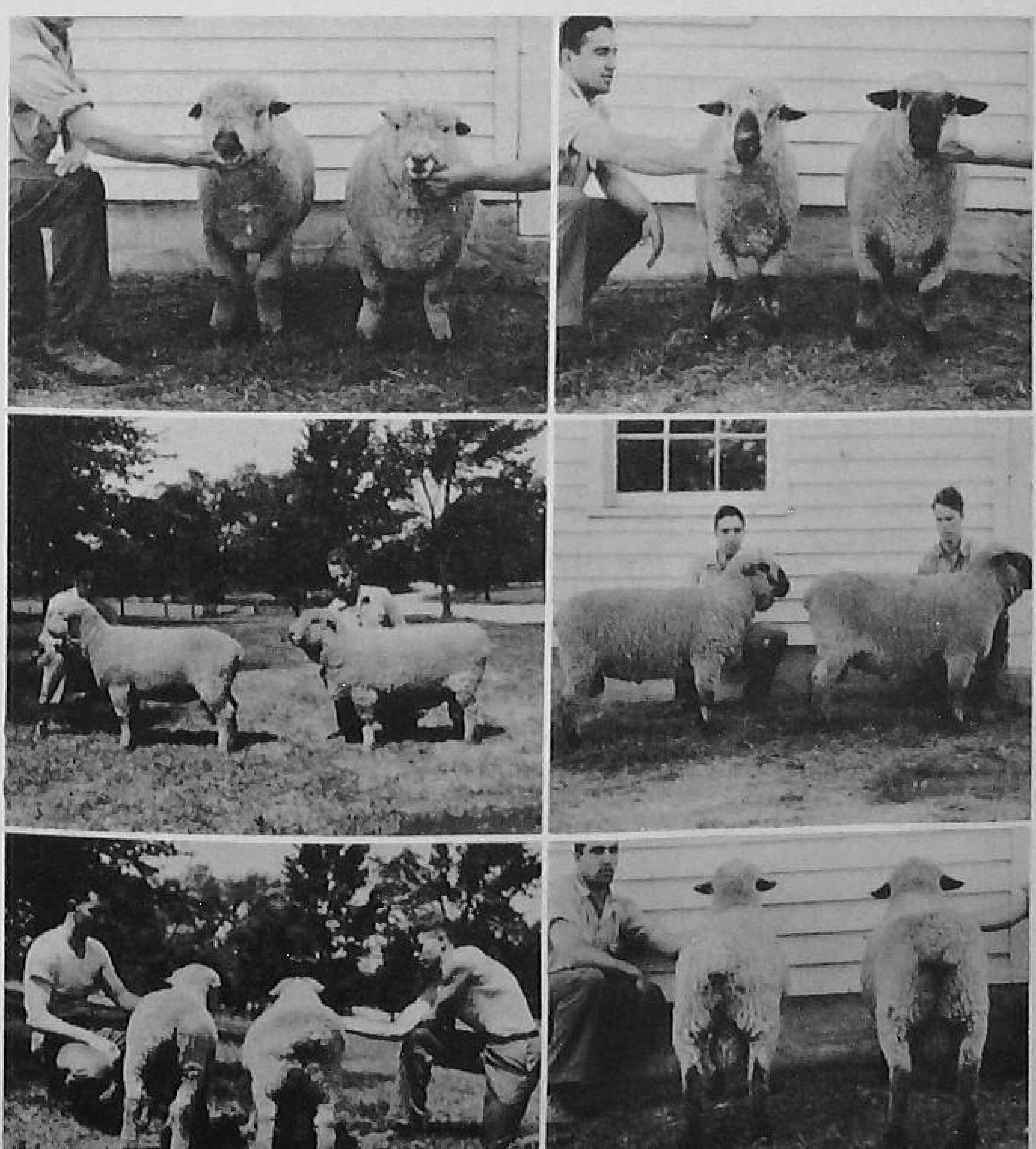


FIGURE 233. *(top, left) A shorn ram. This ram is of good type. When the fleece is off more can be seen with the eye. (top, right) Using the hands to determine the smoothness of the shoulders. (bottom, left) Determining the depth of the fore quarters. (bottom, right) Measuring the width of the loin. (Courtesy University of Minnesota.)*

If the animals are shorn, more may be seen by the eyes than when they are in the fleece. Although one must use both the eye and the hand to judge, a general idea of the conformation may be gained by sight alone. As in judging other livestock, one must first survey the animal from a distance of from about 10 to 15 feet. From a side view the animal should appear compact, blocky, low-set, with a straight top and underlines. The legs should be strong with short, reasonably straight pasterns. From a front view the muzzle should be broad and square, nostrils large and wide, and the eyes alert. The head should show masculinity in the ram and femininity in the ewe, but should be free of coarseness. The chest should be deep with good width between the front legs. The shoulders should blend smoothly with the body.

From the rear of the animal one should observe the width and uniformity of width from shoulders to dock. Remember the back and loin are where the lamb chops and

FIGURE 234. *(top, left) Finding the width of the dock. (top, right) Determining the depth of the twist. (bottom, left) Determining the amount of muscling in the leg. (bottom, right) Examining the fleece and skin. (Courtesy University of Minnesota.)*

the dock wide, and the legs full and plump. The animal should move with ease and style.

After gaining a general idea by looking over the animal from at least three positions, step immediately behind the sheep, placing both hands around the neck. Observe whether the neck is short and thick, well-blended into the shoulder. Bring the hands back on either side at the shoulders. Is the heart girth full, or do you find a depression behind the shoulder down along the side? Next, bring the hands up just below the top line on either side and work back to the dock. The animal should be wide, uniform in width, and have a well-sprung rib. Place one hand on the top over the shoulder with palm down. The shoulder should not be open. Work back over the top to determine if the back is straight and strong. Place one hand between the hind legs with palm up. The other hand should be placed on the dock with palm down. This will tell the depth of the twist. Since a valuable part of the carcass is produced by the hind quarters, it is important that they be well developed. By placing both hands around the thigh the size of

the leg may be determined. Examine the udder of the ewe to make sure it is sound.

Taking a position at the side and facing the animal, open the fleece on the opposite side (never on top). Open the fleece on the shoulder, near the middle of the body, and on the hind quarter. The fleece should be long, dense, fine, and have a good crimp: There should be no black fibers, and the yolk or oil should be evenly distributed. The fleece covering should be uniform over the body. The skin should be pink and healthy in appearance.

Breeding sheep need not be fat, but the amount and uniformity of natural fleshing is important. Market lambs should show sufficient covering to produce a good carcass. Excess fat is undesirable in market lambs.

Age. In the absence of records, the age of sheep, until they are four years old, can be determined quite accurately by an examination of the teeth. Beyond four years of age the teeth may indicate the future usefulness of the animal, but will not show its age.

The lamb has eight milk teeth in the lower jaw. Between twelve and eighteen months the center pair is replaced by permanent teeth which are much longer and wider. At two years of age the second pair of permanent teeth appear, and at three years of age the third set is present. When the sheep reaches its fourth year, the last, or fourth, pair of permanent teeth have replaced the milk teeth. The animal is then said to have a *full mouth.*

After four years the teeth begin to slant forward. As the sheep ages, the teeth spread and eventually break off. At this stage they are referred to as *broken mouth*, and when all teeth have disappeared they are called *gummers.*

Selection Based on Production Records. The surest way of selecting animals for breeding purposes is on a production test. Production testing includes: (1) type and finish at weaning time, (2) prolificacy, (3) rate of gain based on weight of lambs at weaning time, and (4) weight and quality of fleece. A ram whose offspring has shown up well in a production test is known as a *desirably proven sire.* Proven sires are not plentiful, and the purchase of breeding stock sired by a proven ram would be less difficult to find and purchase than the proven sire himself. Animals sired by a ram with a number of offspring that have shown up well under production testing are usually quite certain to give satisfaction.

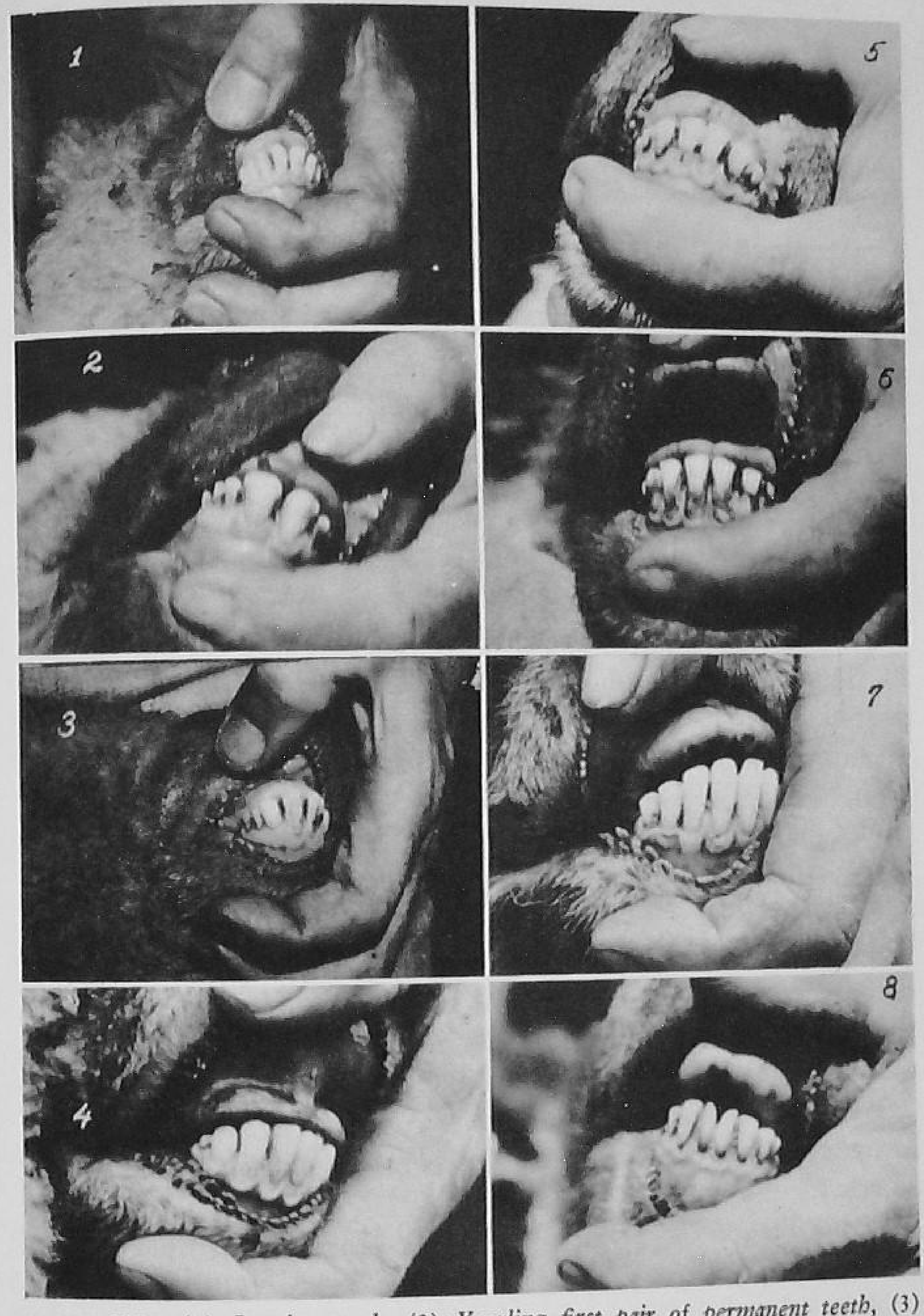


FIGURE 235. (1) *Lamb mouth,* (2) *Yearling first pair of permanent teeth,* (3) *Two-year-old,* (4) *Three-year-old,* (5) *Four-year-old,* (6) *Five-year-old,* (7) *Six-year-old,* (8) *Seven-year-old.* *(Courtesy Michigan State College.)*

SELECTION OF FEEDER SHEEP

Feeder sheep are sheep that are to be fattened for slaughter purposes. Most of the feeders consist of lambs, but a few ewes and yearling wethers go into the feed yards. The selection of feeder sheep is done mostly on an age and grade basis. Table 39 lists the classes and grades of feeder sheep.

TABLE 39

CLASSES AND GRADES OF FEEDER SHEEP

Sheep or Lambs	*Sex*	*Age*	*Weight*	*Grades*
Feeder sheep	Ewes and wethers	Yearlings	All weights	Fancy, choice, good, medium, common
	Ewes	Two years old or older	All weights	Choice, good, medium, common, inferior
Lambs	Feeder lambs	All ages	All weights	Fancy, choice, good, medium, common, inferior
	Shearer lambs	All ages	All weights	Choice, good, medium

Feeder Lambs. Feeder lambs are young animals, wethers or ewes, under one year of age that are not carrying sufficient finish for slaughter. Such lambs are purchased usually by someone who desires to fatten and later market them as finished lambs. The grade classification indicates the probable quality of the finished lamb. Fancy is the highest grade, but since very few lambs meet the qualifications for fancy grade and those that do are bought largely for exhibition purposes, choice is recognized as the top commercial grade.

Body conformation largely determines grade. Low-set, blocky, compact, and thrifty lambs make up the higher grades, whereas the leggy, shallow-bodied kind fall into the lower grade classification.

Wethers. Wethers are male lambs castrated at an early age before they reach sexual maturity and before they develop the characteristics of a ram.

Feeder Sheep. Sheep that are over a year old but must be fattened before marketing are known as *feeder sheep.*

Shearer Lambs. Shearer lambs carry nearly a full year's growth of wool. Such lambs are usually shorn before going into the fattening yard, especially during warm weather. Shearer lambs bring less money on the slaughter market per pound than do lambs in fleece. However, the value of the fleece plus the better gains during hot weather more than offset the lower market value.

Selecting Feeder Lambs on a Grade Basis. "What grade of feeder lambs shall I buy?" is the first question the lamb feeder must answer. The answer will depend on the difference in price between the grades and the kind and amount of feed he will use.

Price. As in cattle, the better grades sell higher, but will usually finish into top slaughter lambs. The higher quality fat lambs sell higher on the market. The degree of difference in the feeder grade price and the price of the corresponding grade slaughter lamb is important in determining profits. If a medium or lower grade feeder can be purchased cheaply enough, it may be a better buy than a choice lot. Very often, especially when the supply of lambs on the market is low, there will be very little spread in the price between fat lamb grades. Under such conditions the lower grade feeders may be the more profitable.

Feed supply. If plenty of good-quality forage and grain is available, the better grades of feeder lambs will usually be a wiser choice. Good feed is more expensive, but will also put on a desirable finish. Choice feeders finished on grain usually top the slaughter market. Since the lamb feeder, who feeds considerable grain, has a rather expensive gain, he will need a good price if he is to make a profit over feed cost.

Where roughage alone or very little grain is to be fed, the lower grades of feeders will probably be a better choice.

Weight of Lamb to Buy. The weight of feeder lambs to buy depends upon the breed, amount of condition the lamb is carrying, and the length of time the feeder plans to feed the lambs. The small, fast-maturing breeds, like the Southdown, will finish out at from 60 to 80 pounds. The larger breeds may not have sufficient finish for top lambs under 100 pounds. If the smaller breeds are the feeder's choice, he will select lighter lambs than if he buys the larger breed of lambs.

Lambs carrying good condition will not need a very long feeding period before they are ready for market. If the feeder wishes to feed for only a short period, then either the small breeds or half-fat lambs should be purchased.

For long feeding periods the larger breeds of thin lambs will meet the needs. A gain of one-third pound per day is considered an acceptable rate of gain. A 40-pound lamb of the small breeds could be expected to be finished in about sixty days, whereas a 60-pound lamb of the larger breed would be on feed about 120 days before it would reach desirable market finish. It should be pointed out that a somewhat greater daily gain could be expected on the larger breeds. Some lamb feeders have succeeded in producing as much as one-half pound daily gain.

SUMMARY

Sheep breeds are divided into six classes according to the type of wool they produce. The classes are: fine-wool, medium-wool, long-wool, crossbred-wool, carpet-wool, and fur sheep. Crossbred-wool-type sheep produce a fleece similar to the fine-wool breeds and are generally listed in the fine-wool class. Sheep breeds in the carpet-wool class are so few in the United States that they are seldom mentioned in the literature.

The fine-wool breeds produce a rather short, fine-wool fiber. The fleece is dense and contains a large amount of oil or yolk. The fine-wool breeds have been developed largely for wool production.

The medium-wool breeds are compact, blocky, and low set in body form. They are well developed in the regions of valuable cuts. Medium-wool breeds are excellent for the production of mutton and lamb.

The long-wool class are large sheep. The wool fibers are long and the carcass quality in general is good, but as a class they do not equal the medium-wool breeds as producers of top-quality carcasses.

The crossbred-wool breeds have been developed as a result of infusion of long-wool and fine-wool blood. The breeds represent a somewhat dual-purpose type, producing a very acceptable fleece and carcass.

Carpet-wool breeds are not common in the United States, and most of this type of wool is imported.

The fur sheep industry in the United States is new, but considerable interest has been developing in the fur sheep breeds. Fur sheep are produced for the lamb pelts, commonly known as Persian lamb.

The common United States breeds of sheep of the fine-wool class are Merino and Rambouillet. The medium-wool class is represented chiefly by Cheviots, Dorsets, Hampshires, Oxfords, Shropshires, Southdowns, and Suffolks. In the long-wool class we find Cotswolds, Leicesters, Lincolns, and Romneys. The more popular crossbred breeds are: Columbias, Corriedales, Panamas, Romeldales and Targhees. The Black-faced Highland is the chief producer of carpet-wool, but very few exist in the United States.

The Karakul is the principal fur breed of sheep and is increasing in numbers in the United States.

Factors to consider in selecting a breed are: Environment, demand, cost, and availability of breeding stock, and personal likes.

Foundation stock should be selected on the basis of body form and production records. The best foundation animals are those that will produce a good fleece and carcass. Animals from a flock showing a high rate in prolificacy, milking ability, growth, and good fleece and carcass quality are more likely to produce satisfactorily than are animals selected from flocks where production records have not been a major consideration.

Feeder sheep are classified according to sex, age, weight, and grade. The class and grades to purchase depend upon the feed supply, price, and length of time the animals are to be in the feed lot.

QUESTIONS

1. List the classes and important breeds of each class of sheep.
2. What class is most important in your community? Does this class best fit the conditions of your community? Why?
3. What are the distinguishing characteristics of the various classes of sheep?
4. Which classes are recognized chiefly for their wool production?
5. Which classes are best suited for the production of top-quality carcasses?
6. How were the crossbred classes of sheep produced? What advantages do they have over other types?
7. What is the chief purpose for which fur sheep are produced?
8. Discuss the factors to be considered in selecting a breed of sheep.
9. Explain how you would select breeding stock on the basis of body form.
10. What production factors are important in the selection of foundation animals? Why?
11. Give the classes and grades of feeder sheep.
12. What are shearer lambs?
13. What should determine which grade of feeder lambs to buy?
14. What factors are important in determining the weight of feeder lambs to purchase?

REFERENCES

Alexander, M. A., Derrick, W. W., and Fouts, K. C., *Farm Sheep Facts*, University of Nebraska, Lincoln, Nebraska, Agricultural Extension Service, Bulletin E.C. 255.

Brown, George, *Selection and Care of the Farm Sheep Flock*, Michigan State College, East Lansing, Michigan, Agricultural Extension Service, Bulletin 242.

Cadmus, W. G., *Sheep Records for Greater Profits*, Oregon State College, Cornvallis, Oregon, Agricultural Experiment Station, Circular. 182.

Jontz, Dewey M., *The Shepherds' Manual*, Iowa State Sheep Association, Des Moines, Iowa, 1949.

< 25 >

Feeding and Management of the Breeding Flock

If a healthy productive breeding flock of sheep is to be maintained, the shepherd should give special attention to his feeding and management practices. The profits from the flock result from the sale of lambs, wool, and breeding stock. The quality, quantity, and price received from the sale of sheep and wool depend largely upon the knowledge and ability of the shepherd.

THE BREEDING SEASON

Ewes, except for a few breeds like the Dorset, seldom come in heat during the hot months of the year. As the nights become cooler, usually in late August or early September, ewes start to come in heat. In the mountainous regions an earlier heat period may be induced by moving the flock into higher altitudes where cooler conditions prevail.

Flushing. When the time of year approaches during which ewes may be expected to start their heat periods, experienced shepherds will put ewes on a grain ration or move them to fresh pasture areas where feed is more abundant. This process is known as *flushing*. Flushing the ewes will hurry the heat periods and result in a greater uniformity of breeding. When the breeding period is spread over a long period of time, the lamb crop will also be strung out, with a considerable lack of uniformity in the age and size of the lambs. Lambs of various ages running in the same area will not compete equally for feed. Younger lambs will be crowded away from the feed bunks, slowing their gains. When there is a considerable lack of uniformity in size and age, the marketing process will also be spread out. For the most efficient gains and the least labor required, it is necessary to have a uniform lamb

crop. Flushing also increases the fertility of the ewes, resulting in a greater number of twins and a higher conception rate.

Ration for flushing. When it is not possible to provide fresh pasture for the flock, the ewes should be given from ½ to ¾ pounds of oats daily or ½ pound of corn, barley, or grain sorghum daily, starting about two weeks before the ram is turned in with the flock.

Trimming the Dock and Face of Ewes and the Sheath of Rams. Before breeding season starts, the wool should be removed from the dock of the ewes. Ewes sometimes are not bred because wool or tags prevent the ram from making satisfactory connection. Wool should be trimmed around the eyes to prevent wool blindness. Clipping the wool on the belly of the ram in front of the sheath will make breeding more certain.

Care of the Feet. Both ewes and rams should have their feet well trimmed so they can walk naturally. It is also a precaution against sore feet. Sheep raised under range conditions usually keep their feet worn down smooth. Sheep under average farm conditions, where less walking for feed is necessary and when they are kept confined in small lots, do not wear down the hoof. Filth accumulates under the hoof causing sore feet or foot rot to develop. A sharp knife or pruning shears may be used to trim the feet.

Overfat Ewes. Ewes should be in good condition, but if overfat, many unbred ewes will result. If it is apparent that ewes are going to be too fat, they should be placed on a sparse pasture or

FIGURE 236. *Trimming the face of a ewe to prevent wool blindness. (Reprinted from* Successful Farming.)

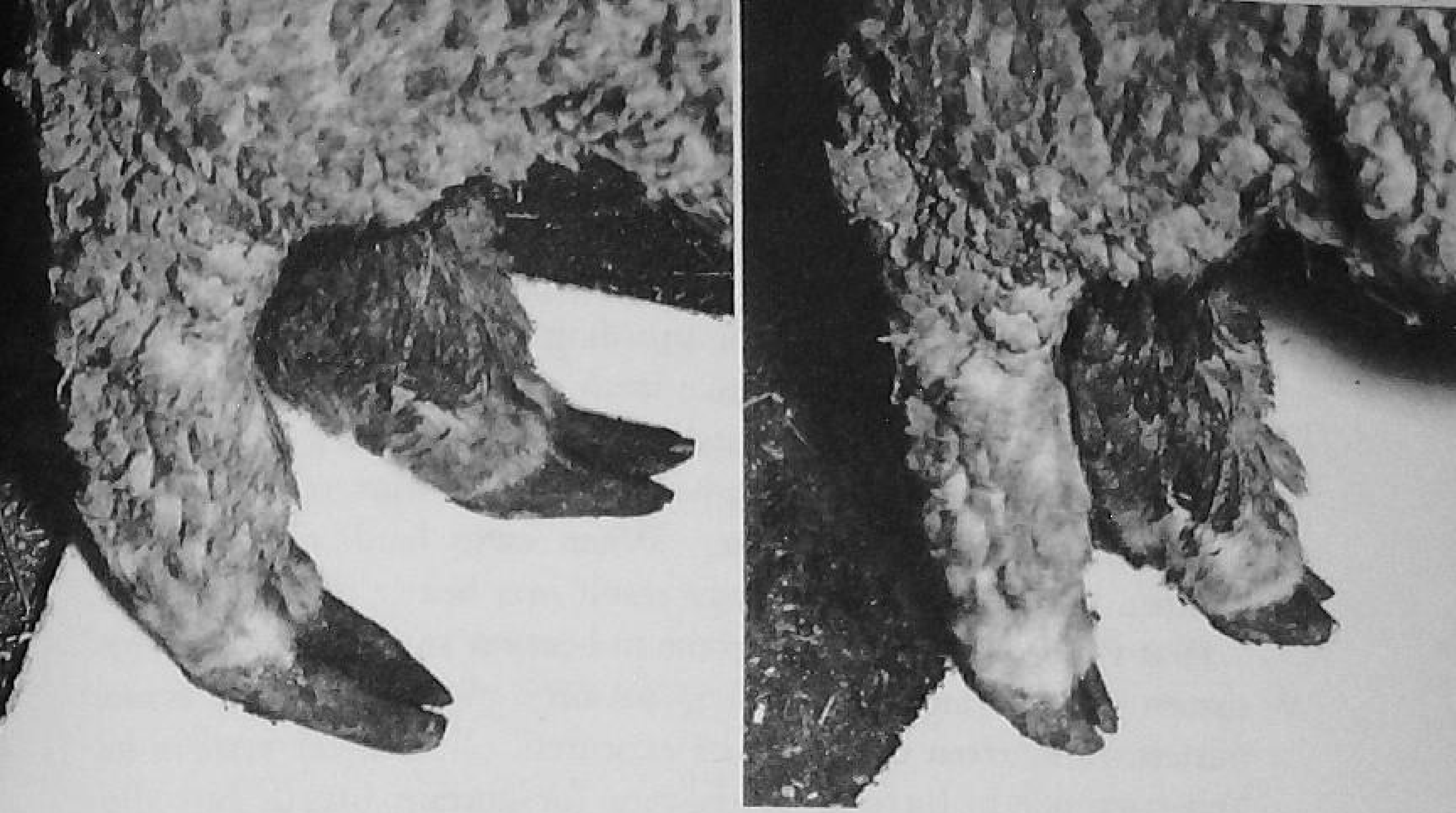


FIGURE 237. *Before (left) and after (right) trimming the feet. (Reprinted from* Successful Farming.)

in dry lot where feed will be limited at least six weeks before the breeding season.

Conditioning the Ram. Well-developed rams should be selected in advance of the breeding season. If the ram is overfat, he should be thinned down by a gradual reduction in feed. If the ram is in normal condition at breeding time, he will need some extra grain during the breeding season. The amount of grain to feed will depend upon the size of the ram. A ration consisting of three parts oats, one part corn, and one part bran by weight and fed at the rate of one pound per day is usually sufficient for the ram during the breeding season. Barley or sorghum grain may be substituted for corn or oats when available.

If the ram is carrying a heavy fleece and the breeding is done early while the weather is quite warm, it is better to shear the ram.

Ewe Ram Ratio. A well-developed ram lamb may be depended upon to breed from ten to twelve ewes. A vigorous, mature ram five years of age will breed from thirty to forty-five ewes per season. A ram turned in only at night will retain his vigor and breed a maximum number of ewes.

Marking the Ram. It is very difficult to determine when a ram is breeding unless the ram is marked. If the brisket of the ram is smeared with a mixture of lamp black and oil or venetian red and oil, he will leave a mark on the ewe when she is bred. More recently ewes are marked by placing a marking harness on the ram and changing the color every two weeks. By inspecting the flock

daily, a record of breeding is established. If the color is changed every sixteen days, nonbreeding ewes may be detected. If the ram is not breeding or if he fails to get the ewes with lamb, the marking system will detect the poor breeding ram while there is still time to replace him and produce a lamb crop.

By marking the ram and establishing the breeding dates, the shepherd will know the time when lambs will start to come and the ewes which will lamb first. When ewes lamb during cold weather, unexpected lambing may result in a heavy death loss.

Heat Period of Ewes. Ewes come in heat on an average of every sixteen days during the breeding season. A variation of from thirteen to nineteen days may be expected. The ewes remain in heat from one to three days. Except for certain breeds like the Dorset Horn, ewes seldom come in heat except during the cooler months. The climatic conditions determine largely the months when ewes will breed.

Hormones as a Means of Inducing Ewes to Breed. In recent years some success has been obtained by the injection of hormones into ewes to bring them into heat during the warm season. The chief advantage of inducing early heat periods is to produce a lamb crop during the late fall. Fall lambs are usually ready for the Easter market and bring a better price than lambs dropped in the spring.

Age to Breed. While a well-grown-out ewe lamb may breed and produce a good lamb, most shepherds prefer not to breed ewe lambs. If ewes are bred to lamb at two years of age, they will usually have a longer productive life. The breeding of ewe lambs often results in undersized ewes unless they are separated from the flock and given special care during the gestation period. Ewes generally complete their usefulness when around seven years of age.

FEEDING AND MANAGEMENT OF PREGNANT EWES

The gestation period of ewes will range from 143 to 151 days. During the gestation period the ewe is developing a lamb. How well she is fed and cared for will determine her ability to produce and suckle a strong offspring.

Feeding During the First Half of the Gestation Period. During the first part of the gestation period the demands on the ewe for nourishing her unborn offspring are not too great. When plenty of good quality roughage, such as legume hays, are fed together

with salt and a mineral mixture, the ewes' nutrient needs will be provided for. However, when low quality roughages, especially those low in protein, make up the bulk of the ration, additional protein and vitamin A or carotene feeds should be provided.

If only a limited amount of good forage is available, it should be saved until the latter part of the gestation period.

Some suggested daily rations for the first part of the gestation period are:

1. Legume hay free choice.
2. 2 pounds corn or sorghum silage
   1 to 2 pounds legume hay.
3. Chopped corn or sorghum fodder free choice
   1/8 pound soybean, linseed, or cotton seed meal.
4. Grass hay free choice
   1/10 pound of protein supplement containing 10 pounds of urea and 90 pounds of soybean meal, or 15 pounds urea and 85 pounds linseed meal.

Salt and mineral should be provided free choice for all the rations. The mineral mixtures recommended for beef cattle may be used for sheep.

Feeding Ewes During the Last Half of the Gestation Period. During the last half of the gestation period, the best forages available should be fed. The rations given for ewes during the first part of the gestation period may be continued, but starting with the eleventh week ¼ pound of grain should be added to the daily ration. Starting with the fourteenth week, the grain ration should be increased to ½ pound. Unless the roughage is entirely legume hay an additional amount of protein supplement should be added. Some grain protein mixtures that will provide the essential nutrients are:

1.	Oats	80 pounds
	Wheat bran	15 pounds
2.	Corn or sorghum grain	40 pounds
	Oats	40 pounds
	Wheat bran	10 pounds
	Protein meal	10 pounds
3.	Barley (ground)	50 pounds
	Corn or Sorghum	40 pounds
	Protein meal	10 pounds

FIGURE 238. *Ewes can be forced to exercise by scattering roughage a considerable distance from the housing area. (Courtesy Geo. A. Hormel & Co.)*

Water is important to all farm livestock. Water kept ice free and fresh will be consumed in greater quantities.

Exercise. Ewes should be allowed all the exercise possible during the pregnant period. When the pastures or corn fields are not covered too deeply with snow, ewes will forage all winter long on these areas, getting the needed exercise to remain healthy and in condition for lambing.

Feeding the Ewes at Lambing Time. Just before lambing time the grain should be reduced to about ¼ pound daily. This will help to prevent milk fever and reduce the milk flow. Lambs receiving too much milk soon after birth may scour. After about three to four days the ewes may be fed the same ration as was given them before lambing.

MANAGEMENT OF EWES AND LAMBS AT LAMBING TIME

If the flock is not too large, it will pay to provide individual lambing pens for the ewes. The use of lambing pens helps to pre-

FIGURE 239. *Temporary lambing pens made from hinged panel. (Courtesy Geo. A. Hormel & Co.)*

vent losses of lambs. Very often ewes producing twins will wander away with the stronger lamb and leave the weaker one to chill or starve. Ewes having twins sometimes move, after having the first lamb, to a different area where the second is born. The first lamb may not be recognized and owned by the mother. When several ewes are lambing at the same time, it is more difficult to identify lambs with their mothers when the flock is running together. By numbering the ewes and giving the lambs the same identification

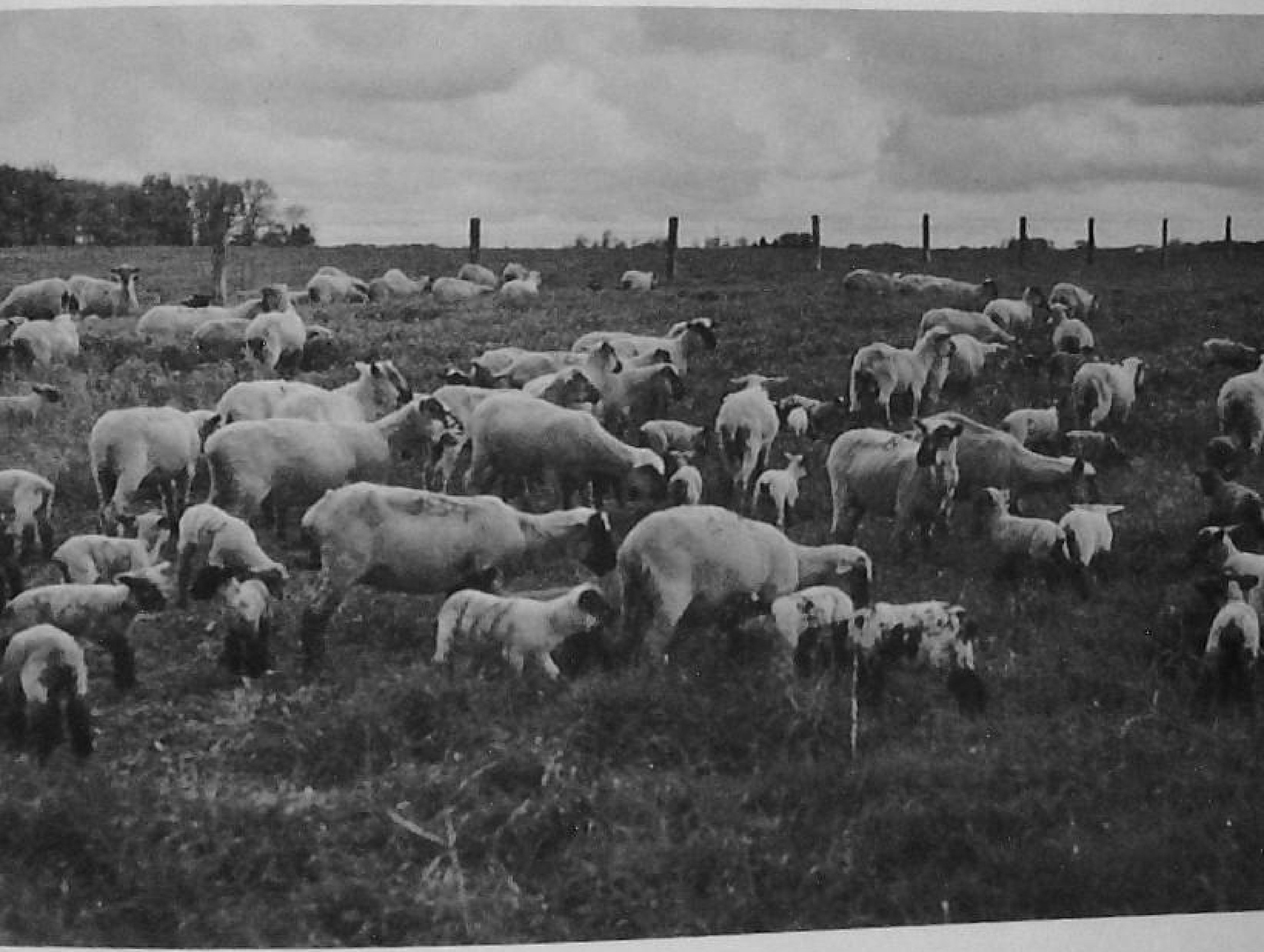


FIGURE 240. *Numbering the ewes and lambs provides for quick identification. (Courtesy Geo. A. Hormel & Co.)*

marks, poor milking ewes or those not producing strong lambs may be more easily identified and later removed from the breeding flock. Lambing pens may be made from panels 30 inches high and 4 feet long, hinged or wired together. Burlap sacks may be placed around and over the pens to make them warmer.

If the ewes are lambing during cold weather, brooders may be provided in the lambing pens as a means of preventing chilled lambs. The more common and least expensive brooders are en-

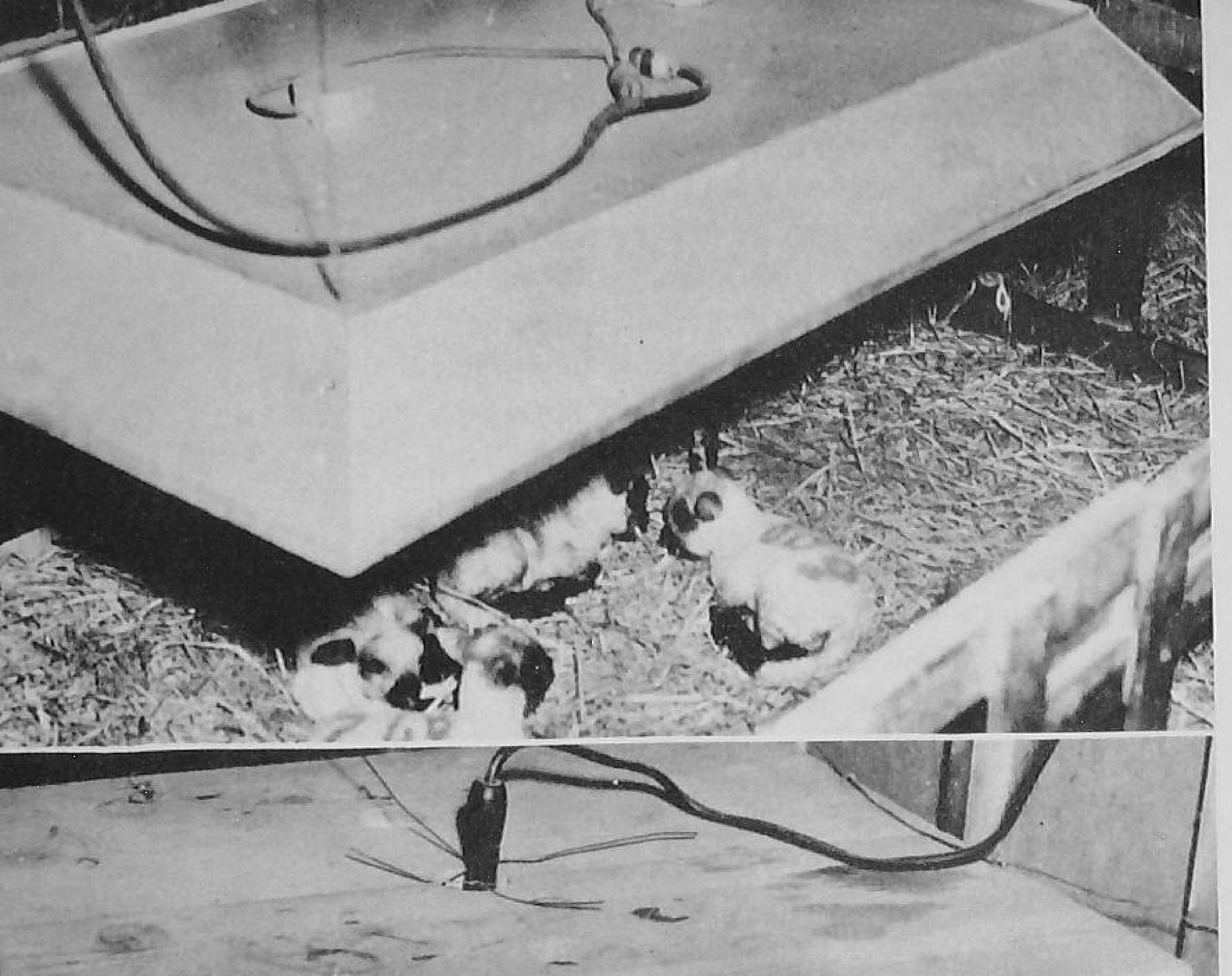


FIGURE 241. *Two types of lamb brooders. (Reprinted from* Successful Farming.)

closures heated with an electric heat bulb and large enough to admit the lambs only.

Preparing the Ewe for Lambing. Ewes about to lamb will sink away on each side of the rump and in front of the hips. The

vulva will enlarge and wax will form on the end of the teats. Milk can be drawn from the udder and the ewe will show restlessness.

It is a good plan to shear the wool from around the teats so the lambs will be able to find them and not suck on a lock of wool.

Delivering the Lamb. Ewes that are vigorous, well fed, and well managed seldom have difficulty in lambing. Do not disturb the ewe during the first stages of labor. However, if it becomes evident that the ewe will need help, wash and disinfect the hand and arm, apply a coating of vaseline to the hand and arm. Lay the ewe on her right side, make entrance, and determine whether the lamb is in proper position. The forelegs should be extended and the head resting on or between them. Do not try to deliver the lamb until it is in correct position. As the ewe strains, pull gently on the lamb. Pull only when the ewe labors. After the head and feet are delivered, pull downward to deliver the shoulders. Care must be taken in twins as one leg of each lamb may be extended. It will be necessary to push both lambs back to correct their position.

Care of the Newborn Lamb. When the lamb is born, pinch off the umbilical cord about four inches from the body. Be sure all mucus is removed from the nose and mouth. The navel should be disinfected with a tincture of iodine to prevent infection.

The lamb should be placed near the ewe's head where she may rest and clean the lamb. When it is apparent the ewe will own the lamb, it is best to leave for a few minutes. A strong lamb will usually nurse unassisted, but weak lambs will need help. Milk a few drops from the ewe to make sure the milk channels are open. Place the teat in the lamb's mouth and squeeze some milk into its mouth. If the ewe's milk does not come down at once, draw some from another ewe. The next best is cow's milk given at the rate of two tablespoonfuls every 2 or 3 hours at about 98° F. Be sure all utensils are clean.

Chilled Lambs. If a lamb becomes chilled, it may be revived by placing it under a heat lamp or in a basket containing straw and a jug of hot water. When the lamb is revived, be sure it gets fed because the warm milk will help to warm it and give the needed energy.

Disowned and Orphaned Lambs. Ewes that disown their lambs are often a problem. Most ewes can be coaxed into owning their lambs if the shepherd has the time and patience. Ewes identify

their lambs by smell. Sprinkling ewes' milk on the lamb will often help. The same method will often induce a ewe that has lost her lamb to take that of another ewe. Tying the ewe in the lambing pen a few days so that the lamb may suck often is all that is necessary.

If it is evident the lamb will have to be raised by hand, it should be given two or three feeds of the colostrum or first milk from the ewe. This may be accomplished by milking the ewe and using a bottle to feed the lamb. The milk should be warmed to 98° F. before feeding. Later, cow's milk may be substituted. The secret of using cow's milk is to feed often but only small amounts at a time. For the first day or so one ounce fed at two-hour intervals is sufficient. Later the amount may be slowly increased and the feeding intervals spread farther apart.

Pinning. The first bowel pasages of the lambs is sticky and often pins the tail to the body, preventing any further excretion. This is called pinning. The tail should be loosened and the excrement cleaned from the lamb.

Care of the Ewe Immediately After Lambing. The ewe should be kept under observation for several days after lambing. The shepherd should be sure the ewe cleans and that her udder and bowels are in good condition. If the ewe is constipated, a drench consisting of ¼ pint of raw linseed oil or 3 ounces of epsom salts dissolved in warm water will start bowel movements. A rectal injection of 1 quart of warm soapy water brings quicker results than giving a laxative. Ewes should be milked out if the lamb fails to take all the milk. This will prevent caking of the udder. The ewe should be given plenty of water and a light feed of bran and legume hay. After a few days, if the ewe and lamb are in good condition, the feed may be increased. When the lamb is ten days old, the ewe should be getting all the hay she can eat plus a daily ration of 2 to 3 pounds of the concentrate mixture used during the last part of the gestation period.

When the ewe is turned on pasture, if the forage is abundant, the grain and hay may be discontinued.

FEEDING AND MANAGEMENT OF THE LAMBS

Castrating. Castrating of the lambs should be done when the lambs are from ten to fourteen days old. Lambs to be castrated should be placed in a clean dry pen where they may be easily

caught. Instruments used for the operation and the hands of the operator should be clean and disinfected. The ewes' pen should be clean and freshly bedded so that the lambs will be in a clean place when placed with their mothers after the operation. There are several methods of castrating. Each method has some advantages as well as disadvantages.

Using a knife. The most common method of castrating lambs is to cut off one-half of the lower end of the scrotum. With the thumb and forefinger of the left hand, force out the testicles by squeezing the base of the scrotum next to the abdomen. Grasp the testicles one at a time with the thumb and crooked forefinger of the right hand and pull outward gently until the cord breaks. A mild disinfectant may be used to wash the wound, but if the operation has been done under sanitary conditions this is usually not necessary. The operation should be done on a clear, warm day.

Castrating by removing the testicles is sure and does not require any special equipment. It does, however, create an open wound which may become infected if precautions are not taken to prevent infection. In screw worm infested areas considerable danger of screw worm infestation exists when animals have open wounds.

Castrating with emasculator or pincers. The emasculator is an instrument used to crush the cord leading to the testicles. The cord is destroyed leaving the testicle to gradually dry up or wither

FIGURE 242. *Castrating with a knife. (Courtesy Iowa Sheep Breeders' Association.)*

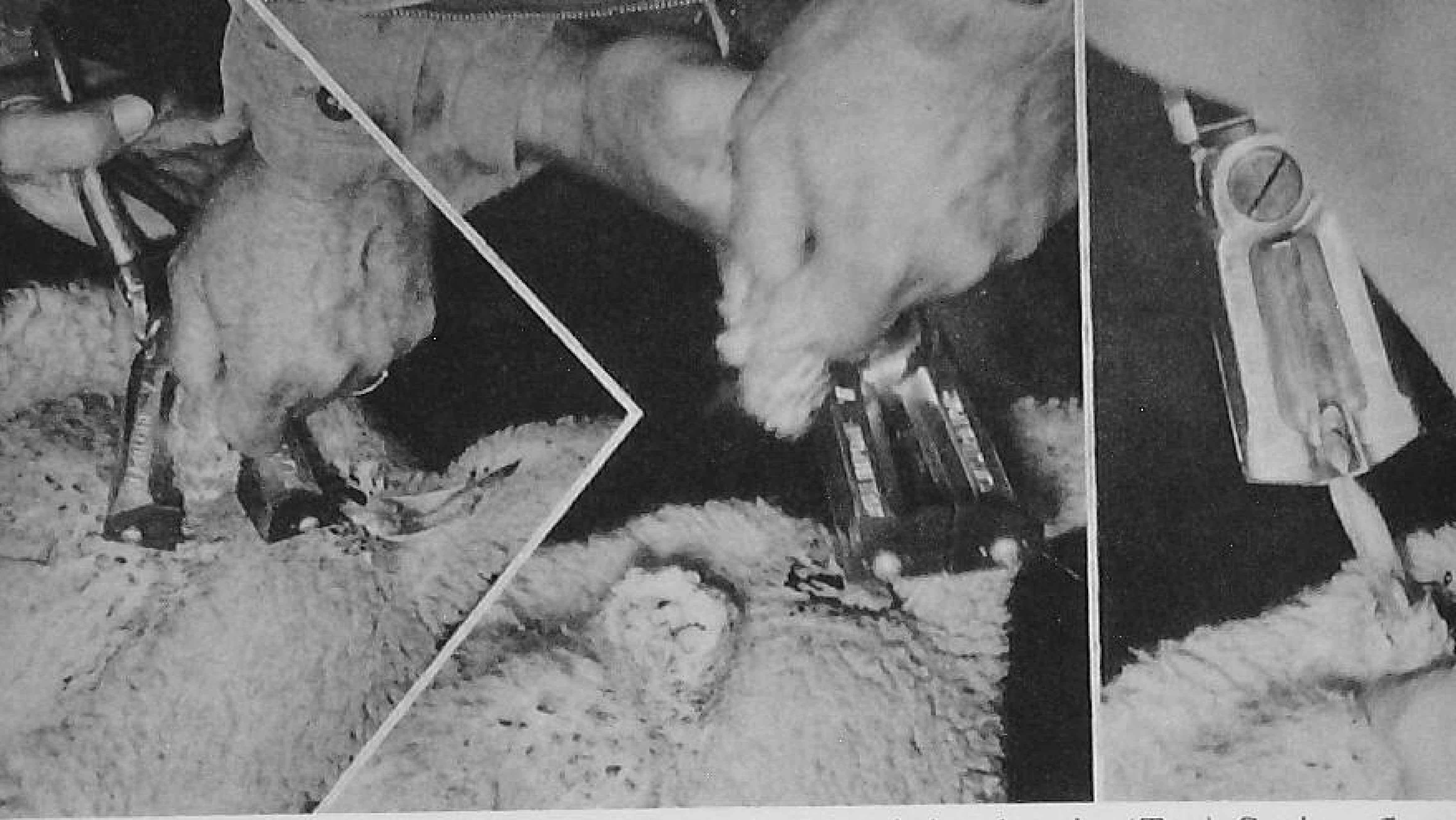


FIGURE 243. *Castrating with a specially designed tool. (Top) Cutting off one third of the scrotum. (Center) Note the testicles protruding. (Bottom) Pulling the testicles gently until cord breaks. (Courtesy University of Nebraska, Agricultural Extension Service.)*

away. This method does not leave an open wound and is bloodless. The operator must be skilled or stagy lambs will result.

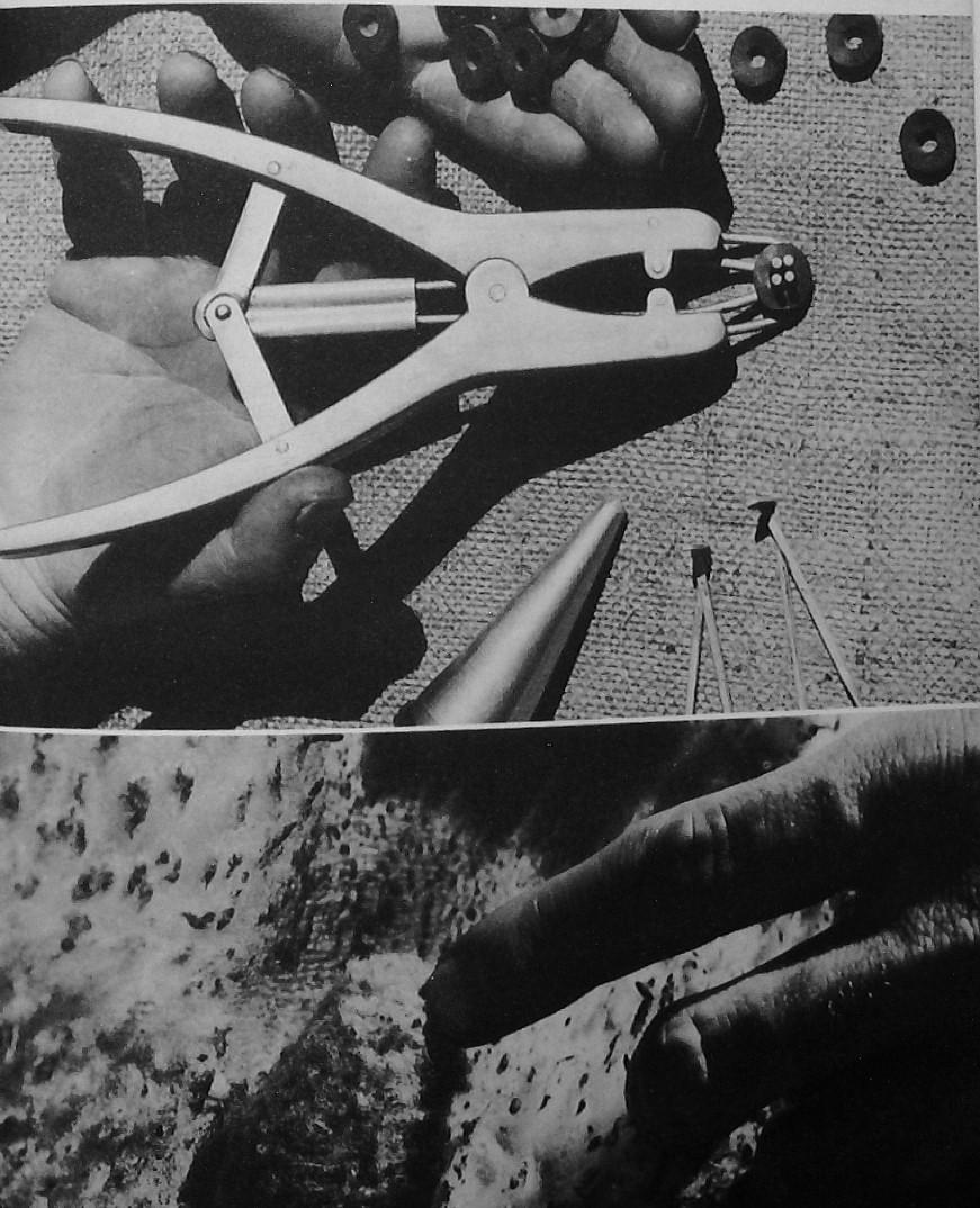
Elastrator. The elastrator is an instrument used to spread tight rubber bands which are slipped over the scrotum and released. The bands fit tightly around the cords at the base of the scrotum near the abdomen. The circulation is shut off and the scrotum and testicles gradually dry off.

Docking. Lambs may be docked at the time they are castrated. Castrating should be the first operation followed by docking.

FIGURE 244. *Castrating by crushing the cord leading to the testicles. (Courtesy Michigan State College.)*

Several methods, all of them designed to remove the tail about 1½ inches from the body, may be employed in docking lambs. Lambs not docked accumulate a great deal of filth around the tail which often results in maggot infestation.

FIGURE 245. *Castrating with the elastrator. (Upper) Rubber bands and elastrator. (Lower) Rubber band in place around the scrotum. (Courtesy University of Nebraska, Agricultural Extension Service.)*



For the first few days while the lambs are learning to eat, the grain-protein mixture should be kept in the creep at all times. After the lambs have started to eat, they should not be given more than they will clean up in twenty minutes. Overfeeding is the most common error made by the inexperienced shepherd.

Grains should never be ground finely for lambs. Except for small hard seeded grains, such as sorghums, whole grains are more palatable. However, when a mixed ration is fed, crushing the grain is usually necessary to get a uniform mixture. It would be difficult to mix protein meals and whole grains, therefore pellets are commonly used.

After the lambs have been well started on feed, a part or all of the oats and bran may be removed from the ration. Molasses may be used to replace part of the corn if it is cheaper per pound of food value than corn. It will require about 80 pounds of corn, 10 pounds protein meal, and 15 pounds of oats and bran to bring a lamb up to a weight of 60 pounds.

When the ewes are turned on grass, it may be advisable to continue the night and morning feeding of the lambs if marketing in July or August is anticipated. Late spring lambs will fatten on grass and their mothers' milk without grain, provided that plenty of forage is available. Lambs intended for the early spring market should not be turned on pasture but kept in a dry lot.

Pastures for Sheep. The best sheep pastures are those that contain a mixture of legumes and grasses. Legumes are high in protein and minerals, and the combination of legumes and grasses provide abundant long season grazing. Mixtures recommended for cattle pastures have proved equally valuable for sheep.

FIGURE 250. *Good pasture solves much of the summer feeding problems. (Courtesy Rath Packing Company.)*

Rotation Grazing. Rotation grazing pays off by providing a longer grazing season and more forage from the same area. For rotation grazing at least three fenced pastures will need to be provided. All the sheep should be placed in one pasture when the grass is 6 to 8 inches tall, but continue feeding some dry forage for about two weeks. When pasture number 1 has about 4 inches of coverage, move the sheep to pasture number 2. When the second pasture has been grazed down to about 4 inches, the sheep should be placed on pasture number 3. By this time the third pasture will have grown up quite rank, but this added growth will provide for considerable grazing until late fall.

Pasture Requirements. The acres of pasture necessary for a flock of sheep will depend upon the kind of forage and growing conditions. About six ewes or twelve lambs are equivalent to one cow in pasture requirements.

Parasite Control. A rigid parasite control program should be followed. Methods of controlling both internal and external parasites are discussed in Chapter 27.

Shearing. If possible, the ewes should be shorn before they go on pasture. Grass has a loosening effect on the bowels, and more stained wool will result if shearing is delayed. When the wool is left on too late in the year, losses from natural shedding will reduce the weight of the fleece, and when the weather becomes warm, ewes in fleece suffer a great deal of discomfort.

Lambs not ready for market or those intended as replacements to the breeding flock should be shorn during July or August. Shorn lambs feed better, are more comfortable, and will gain faster during warm weather if the fleece is removed. Lambs intended for the early market should be left in fleece because of the added market value of the pelt.

When sheep are sheared, the wet dirty wool should be removed and packed separately. Wool from black sheep or those with high percentage of black wool fibers should be packed separately. Since the fleece from yearling sheep is more valuable, it should be kept separate. The body should be sheared close and second cuts should be avoided. The long, staple wool will grade higher and bring a better price.

Shear the sheep on a clean floor or canvas where the wool may be kept free from chaff and dirt. Use care in picking up the fleece and in packing it so as not to break it apart. When wool is packed,

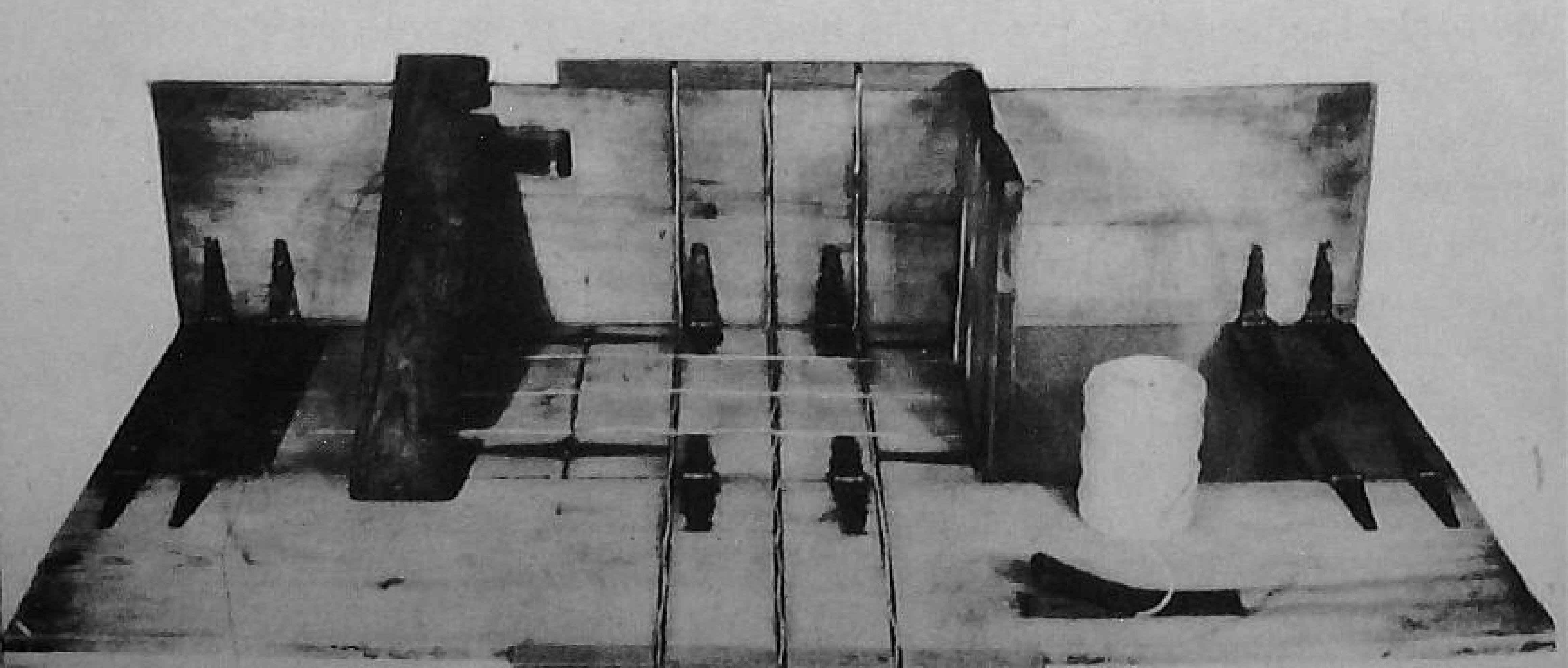
FIGURE 251. *Shear sheep in a clean place. (Courtesy Sunbeam Corporation.)*

spread the fleece out, flesh side down, and fold in about 10 inches of each side, starting at the tail and rolling it into a fairly loose bundle. Using a regulation wool board and paper twine, tie each fleece separately. Never use sisal or hemp twine as the fibers from twine become mixed with the wool.

Place the wool in regulation wool sacks and store in a dry place. Wool piled on the ground or in a damp area will be seriously damaged.

Weaning the Lambs. Lambs will need to be weaned when the forage is insufficient to provide enough feed for the lambs and

FIGURE 252. *Use a wool board when tying the fleece. (Courtesy Michigan State College.)*

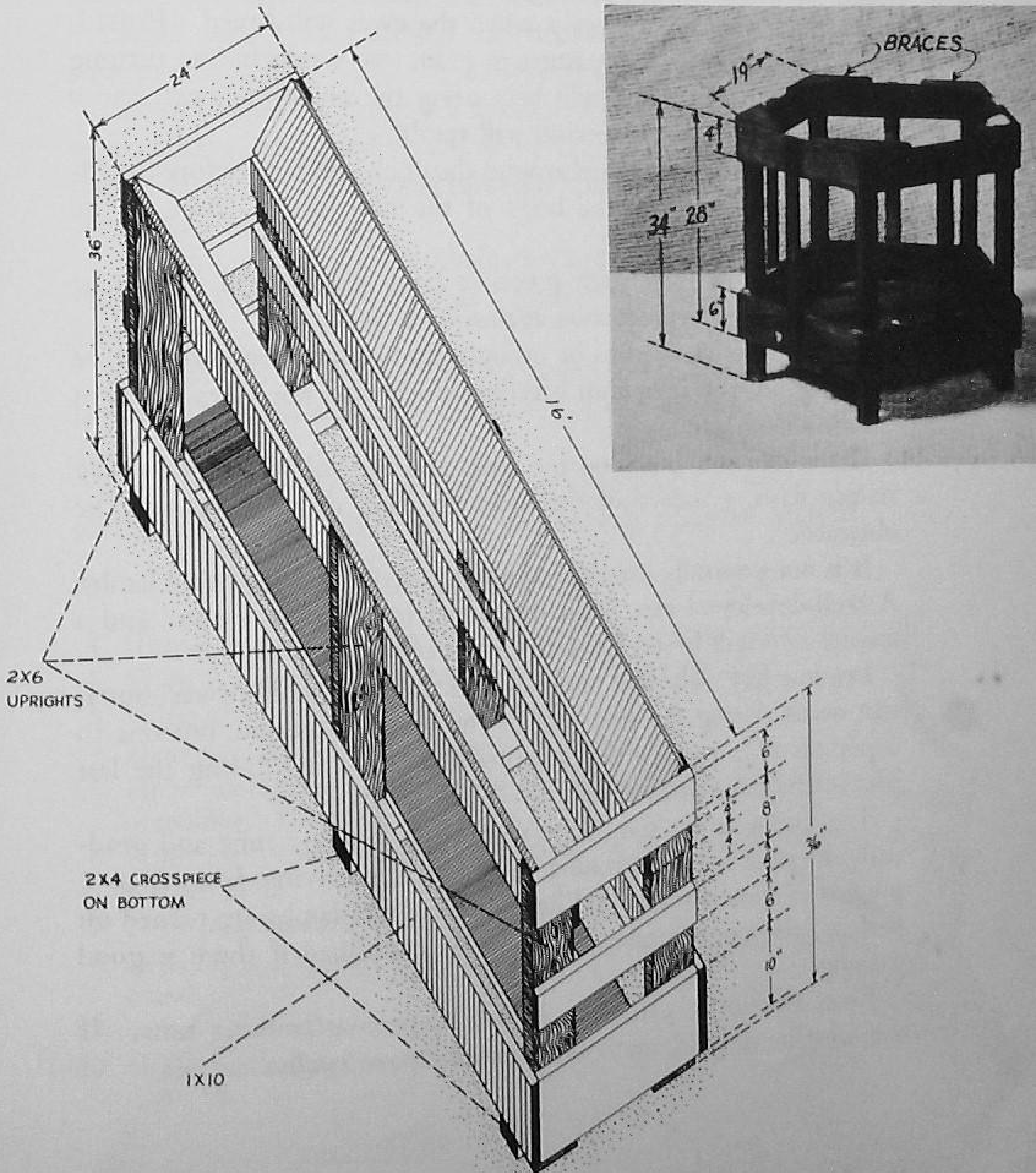


ewes. It is not practical to attempt creep feeding on pasture. When the lamb crop is late and the ewes are to be bred early for the next lambing, it may be necessary to wean the lambs in order to get the ewes in condition for breeding.

EQUIPMENT FOR SHEEP

Equipment need not be expensive for sheep production. Hay racks, feed bunks, watering facilities, and sheds are needed.

FIGURE 253. *Two types of hay racks used by sheepmen. (Courtesy Iowa Sheep Breeders' Association.)*



Housing. Sheep do not require warm housing except when lambing during cold weather. Sheds that open on the south will provide protection from storms and winds and are all that is needed for the older sheep. A warm place will need to be provided for early lambing.

Feed Racks and Bunks. Feed racks and bunks that can be easily cleaned, and will provide enough feeding space, are necessary equipment. Several types of racks and bunks may be used.

SUMMARY

Ewes come in heat during the cooler months. The climatic conditions determine largely when the ewes will breed. Providing the ewes with fresh pasture or grain two weeks before turning the ram with the flock will help bring the ewes into heat, and a more uniform lambing period will result.

Ewes should be trimmed around the dock and face before breeding, and the wool on the belly of the ram just in front of the sheath should be clipped.

Any ewes or rams with excessive hoof growth will need their feet trimmed as a protection against sore feet.

Ewes and rams need to be brought into proper condition before breeding. Overfat or thin breeding stock does not often result in the best lamb crop.

If the ram is marked on the chest and the color changed every sixteen days, a record of the breeding dates of the ewes may be obtained.

It is not generally considered good practice to breed ewe lambs. A well-developed ram lamb can breed ten to twelve ewes and a mature ram will breed forty-five ewes per season.

Legume hay, salt, and minerals will take care of the ewes' nutritive needs during the first half of the gestation period, but one to 2 pounds of a concentrate mixture should be fed during the last part of the pregnant period.

The ewe's ration should be reduced at lambing time and gradually increased after lambing until she is receiving from 2 to 3 pounds of concentrates. When the ewes and lambs are turned on pasture, the concentrates need not be continued if there is good grazing.

Ewes should be placed in individual pens at lambing time. If the weather is cold, lamb brooders will save lambs.

The udder of the ewe should be shorn before lambing. Most ewes will lamb without difficulty, but some will need help. The newborn lambs will usually feed without help, but if it is weak or if the ewe fails to own it, the shepherd will have to give needed assistance. Chilled lambs may be revived by applying artificial heat.

The mother's milk is best for the lamb or the milk from another ewe; as a last resort cow's milk may be used.

The tails of newborn lambs are often pinned to the animal as a result of the first feces, which is very sticky. The tail should be loosened, and the excrement cleaned away.

Lambs should be castrated and docked by the time they are fourteen days old. Any one of several methods are satisfactory.

Lambs should be creep-fed a ration of concentrates and good legume hay. Overfeeding should be avoided. Concentrates need not be fed when the flock is turned on pasture except when lambs are to be marketed early.

Legumes and grasses in combination make the best pasture. Rotating the pastures will provide a greater amount of grazing from a given area.

Ewes should be shorn at the beginning of the warm season, and lambs to be marketed in late summer should be shorn in June or July.

Equipment needs are not large nor expensive for sheep. Open sheds, except for early lambing, will provide necessary shelter.

QUESTIONS

1. During what season can ewes be expected to come in heat?
2. What is meant by flushing? How is flushing done?
3. What advantages result from flushing ewes?
4. How should the ewe be prepared for breeding?
5. How would you recommend conditioning the ewe flock for breeding? The ram?
6. How many ewes may a young ram be expected to breed? A mature ram?
7. How may breeding dates be established?
8. What is the average length of time between the heat periods of ewes?
9. What age should ewes be bred the first time? Why?
10. What is the length of the gestation period for ewes?

quality market lambs. By the time they are finished, they are too heavy to bring top prices. Small, unthrifty lambs are not a good buy, as a rule. Unthrifty, undersized lambs usually result in heavy death losses. Most feeder lambs come from the range where the breeds used are of the large type. Sixty-pound lambs are generally considered a good weight. When a 60-pound lamb is fed during the average feeding period of ninety to one hundred days, he should finish at 90 to 100 pounds, which is an acceptable market weight.

Where to Buy. When large numbers of feeder lambs can be handled, they may be purchased directly from the range. If only a load or so is wanted, a dealer or commission firm will provide them.

Sources of Profit. The lamb feeder's profit depends upon the increase per pound value of the fat lamb over the feeder lamb cost (margin) and the amount he receives for the gain over feed and other cost of securing the added weight. If the feeder is to make a profit, he must have thrifty, fast gaining, and good quality lambs at a price that will allow a profit.

FATTENING LAMBS

Starting Lambs on Feed. Lambs will lose from 4 to 7 pounds in shipment, depending upon the distance and length of time they are on the road. Upon arrival they will be tired, hungry, and thirsty. They should have plenty of water and be allowed to rest in comfortable quarters. A nonlegume hay that is not too rich should be used to fill them after having had a few hours rest. Prairie grass, blue grass, or second growth timothy or brome grass pasture may be used to fill the lambs. Legume hay or pasture may start scouring or bloat if used the first few days. The lambs may be allowed to graze on any recommended available forage or started on feed in the dry lot.

After the lambs have become adjusted to their new environment, which will require about a week, a slow change-over to good quality legume hay and a little grain may be started.

Whole oats or a mixture of oats and other grains may be used as the first grain fed. The first feed should consist of not more than ¼ pound per head. The grain should be increased a little each day until the lambs are on full feed, which should take about three weeks. Full feed consists of the amount the lambs will clean

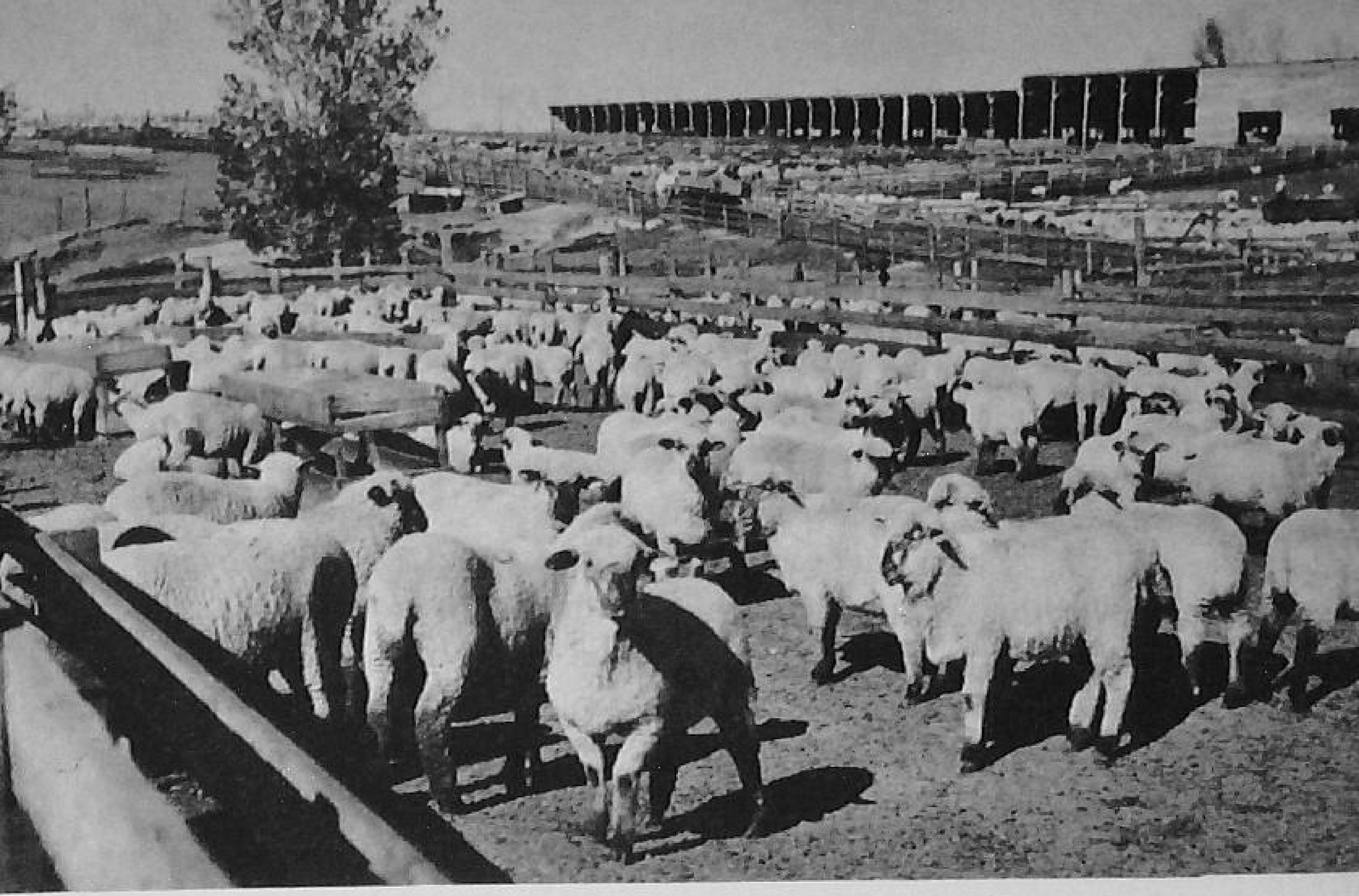


FIGURE 255. *Lambs in the feed lot. (Courtesy Rath Packing Company.)*

up in twenty minutes. In the corn producing area the grain can gradually be shifted to corn.

Grains Compared for Fattening Lambs. Shelled corn is recognized as being at the top of the list for lamb feeding. Sorghum grains have given results about equal to corn. Barley has 80 to 90 per cent of the value of corn for lamb feeding. Oats are excellent for furnishing bulk when starting lambs on feed, but should be replaced by other grains later because oats fatten much more slowly. Wheat and rye may be used to replace up to 50 per cent of the other grains when the price per pound of digestible nutrients is no higher than corn. Beet pulp or molasses can be successfully used to replace part of the grain.

Roughages Compared for Fattening Lambs. Alfalfa hay is one of the best roughages for lambs. Clover and other legume hays will give nearly equal results when compared to alfalfa. Legume hays are very desirable but not essential for lamb fattening. When nonlegume roughages are used, some additional protein meal should be provided in the concentrate ration. Legume-grass silage or corn silage make excellent roughages for fattening lambs. Corn silage will need to be supplemented with additional protein, because it is low in this nutrient.

Protein for Lambs. When high quality alfalfa hay or legume silage is fed as the only roughage, extra protein feeds are not es-

sential. Feeding trials have shown somewhat higher gains when protein supplements are fed, but the cost is too high to be offset by the gain. When low protein roughages are used the feeding of protein supplements will be profitable. Cottonseed, soybean, linseed, and corn gluten meals are all good. A blend of urea and protein meals may be used.

Self-feeding versus Hand-feeding. Lambs may be placed on self-feeders after having become accustomed to grain, if the ration is made bulky by mixing roughages with the grain. A greater danger of overeating exists, but when large numbers are fed, the labor-saving factor is important. A mixture of 30 pounds of grain and 70 pounds of chopped alfalfa will provide sufficient bulk to help prevent the lambs from overeating. The change from hand-feeding to self-feeding should be done slowly. The lambs are given their regular feed, and later the self-feeders are opened. As the

TABLE 40

HAND-FED RATIONS FOR FATTENING LAMBS ON FULL FEED

	Feed	*Daily Ration per Head (lb.)*
1.	Alfalfa hay	1¼
	Corn or Sorghum Grain	1½
2.	Legume Grass Silage	3
	Corn, Sorghum, or Barley	1¼ to 2
3.	Grass hay	1¼
	Corn or Sorghum Grain	1½
	Protein meal	⅛

Salt and lime or salt and bone meal mixture self-fed for all rations.

TABLE 41

SELF-FED RATIONS FOR FATTENING LAMBS ON FULL FEED

	Pounds	
1.	50	cracked corn
	15	molasses
	9	linseed meal
	26	ground legume grass hay
2.	30	cracked corn
	20	cracked barley
	17	molasses
	7	soybean meal
	26	chopped alfalfa

Salt and lime or salt and bone meal mixture self-fed for rations, 1 and 2.

	Pounds	
3.	60.00	shelled corn
	4.00	soy bean oil meal
	34.57	chopped hay
	.15	salt
	.70	limestone
	.50	bone meal
	.08	trace minerals
4.	50.00	shelled corn
	3.00	soybean oil meal
	45.67	chopped hay
	.15	salt
	.50	limestone
	.70	bone meal
	.08	trace minerals

lambs become used to self-feeding, the mixture may be made with a larger percentage of grain.

Some recommended rations for hand-feeding and self-feeding lambs on full feed are given in Tables 40 and 41.

In a recent feeding trial, conducted jointly by Iowa State College and the Rath Packing Company, very good results were obtained when a supplemental protein mineral blend was used to replace the linseed meal in a complete ration. The supplemental blend consisted of:

853 pounds linseed oil meal
800 pounds soybean oil meal
200 pounds urea
15 pounds trace mineral mixture for ruminants
100 pounds special bone meal
31 pounds sodium sulphate
1 pound 9F irradiated yeast

The total ration hand fed consisted of:

56.5 pounds cracked shelled corn
15.0 corn molasses
4.5 supplemental blend
24.0 mixed ground hay

Feed Requirements Per Hundredweight Gain. To fatten lambs from 90 to 100 days it will require about 2 to 2½ bushels of corn (or the equivalent in other grains) and about 140 pounds of alfalfa hay. If the lambs gain the standard gain of ⅓ pound per day per head, the feed requirement for 100 pounds of gain will be 5 to 6 bushels of corn and 420 pounds of alfalfa hay. Sheep compare very favorably with other livestock in economy of gain.

The Use of Hormones to Increase Gains. In recent experiments two hormones, stilbestrol and progesterone, have resulted in feed savings of up to 20 per cent and a 15 per cent faster gain when implanted in the necks of lambs. However, more research will need to be done on carcass quality and general effect on the meat before their use can be generally recommended. However, there is a good reason to believe the use of hormones in lamb feeding will have practical value and lamb feeders should follow the results of the research very closely.

EQUIPMENT FOR LAMB FEEDING

Shelters and Lots. Lambs being fattened do not need warm shelters. Sheds that open on the south in order to provide protection from cold, wet weather and winter storms are all that is needed. Because lambs dislike mud, lots should be well drained.

Feed Bunk and Hay Racks. Unless the lambs are being self-fed, hay racks and grain bunks should be separate. Grain bunks should be large enough to provide 1 foot of space per lamb for hand-feeding and ⅓ foot for self-feeding. Hay racks constructed in a way that will prevent waste are important.

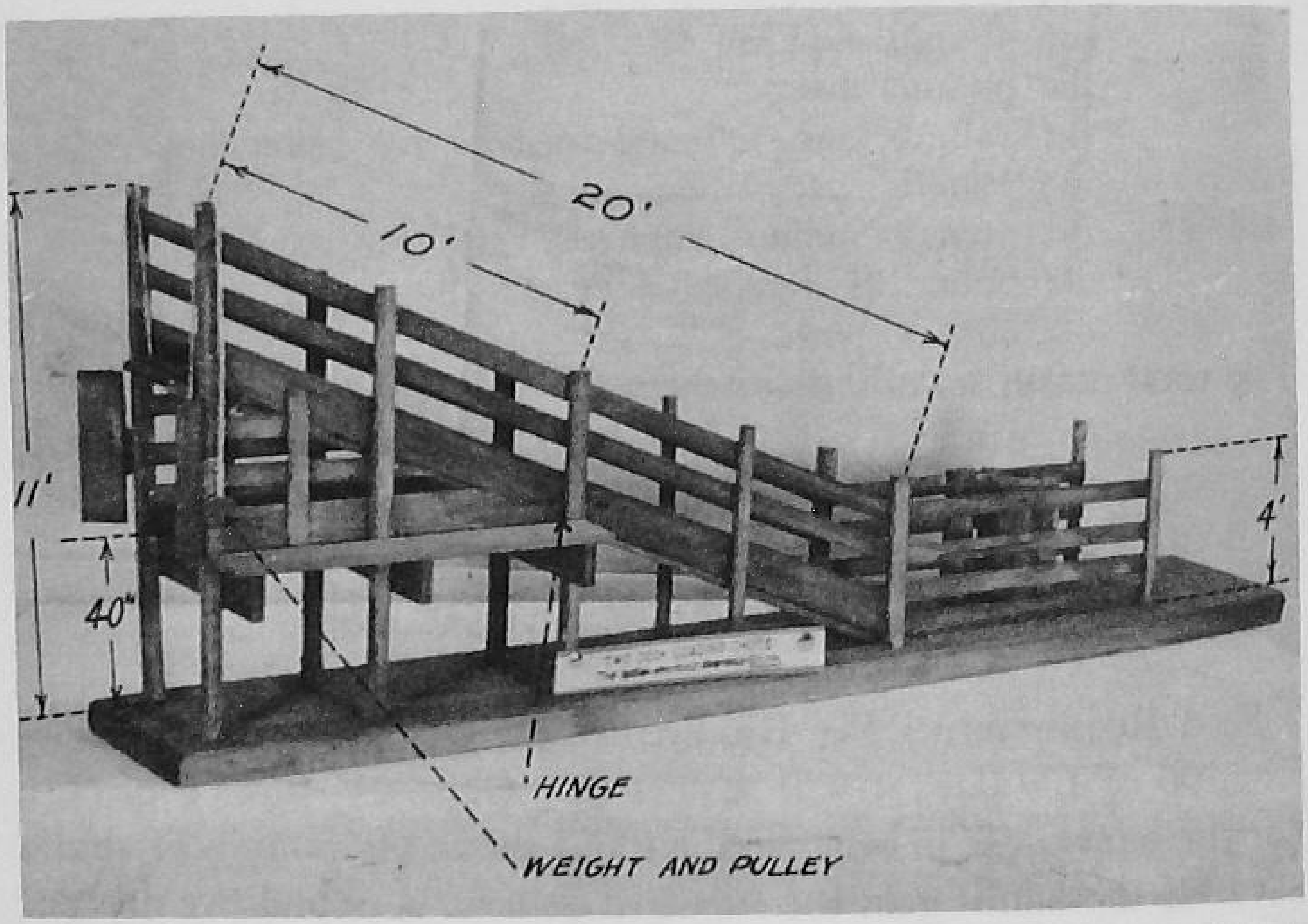


FIGURE 256. *Two-deck loading chute. Width may vary from 2½ to 4 feet. (Courtesy Iowa Sheep Breeders' Association.)*

FEED LOT TROUBLES

It takes a considerable amount of experience to feed lambs successfully. There is a greater danger of lambs having digestive troubles from overeating than any other kind of farm livestock.

A disease commonly known as overeating disease causes considerable losses among fattening lambs. A bacterin has been developed which is about 85 per cent effective in the control of the disease. As a control measure for overeating disease, many lamb feeders vaccinate their lambs before they go into the feed lot. The addition of two pounds of sulphur per hundredweight of feed has

given some success in the control of the disease. Lambs seriously affected with scours should be removed and given a tablespoon of castor oil, and the feed should be reduced until the condition clears up.

Close observation is necessary in successfully feeding lambs. The feeder should check each day to determine whether any lambs are off feed, or whether any digestive difficulties have shown up. If a very large percentage are affected, the concentrate part of the ration should be reduced.

SUMMARY

Lamb feeding consists of buying lambs (usually from the range) —either directly or through a dealer or a commission firm—that do not carry sufficient finish for the packer, and fattening them. Low-set, blocky, compact, and thrifty lambs, weighing around 60 pounds, generally make the best feeders.

When lambs reach the feed lot, they should be allowed to drink and rest. After resting a few hours a slow fill on a grass hay or a grass pasture is the next step in starting lambs on feed. A gradual shift to legume hay and grain should be done, taking at least three weeks to bring the lambs up to full feed.

Corn is the leading grain, but many other grains such as sorghums, barley, or wheat may be used. Beet pulp or molasses may replace a part of the grain.

Alfalfa is the most desirable roughage, followed closely by other legumes. Corn or sorghum silage, grass silage, fodders, and grass hays may be used. When low protein roughages are used, the protein deficiency should be made up by feeding high protein meals.

Linseed, soybean, cottonseed, and corn gluten are all good protein supplements. Minerals should be provided free choice. Ruminant mineral mixtures or a mixture of salt and bone meal (or salt and lime) provide the needed minerals under most circumstances.

Lambs may be successfully self-fed if the ration is made bulky by mixing concentrates and roughages.

Hormones have increased gains and reduced feed cost when implanted in the necks of lambs. Further research is necessary before the practice may be generally recommended.

Open-front shed, well-drained lots, feed bunks, and watering facilities make up the needed equipment for lamb feeding.

Overeating disease, scours, and other digestive troubles cause the

lamb feeder much concern. Careful observation and treatment will reduce these losses. Vaccinating for overeating disease has proved to be about 85 per cent effective.

QUESTIONS

1. In what areas are most lambs fed? Why?
2. Where and how may feeder lambs be secured, and what kind of lambs are best for fattening?
3. What are feeder lambs?
4. What does the lamb feeder depend upon for his profits?
5. How should lambs be started on feed?
6. What are some suggested rations for fattening lambs?
7. How do the grains compare for lamb feeding?
8. How do the various roughages compare for lamb feeding?
9. How may minerals be provided for lambs?
10. List some important protein supplements used in fattening lambs.
11. Make a list of needed equipment for lamb feeding.

REFERENCES

Brown, George A., and Blakeslee, Leonard H., *Self-feeding vs. Hand-feeding, Fattening Lambs, and Rations for Self-feeding Lambs*, Michigan State College, East Lansing, Michigan, Agricultural Experiment Station Special Bulletin 303.

Morris, W. E., and Jordan, P. S., *Fattening Lambs*, University of Minnesota, St. Paul, Minnesota, Agricultural Extension Folder 37.

Quayle, W. L., and Paules, L. H., *Fattening Lambs on Home-Grown Feeds*, University of Wyoming, Laramie, Wyoming, Agricultural Experiment Station Circular 44.

< 27 >

Control of Diseases and Parasites

The purpose of this chapter is to present the methods of prevention rather than the cure of sheep diseases. By following a carefully planned sanitation program and making proper use of sprays, disinfectants, vermifuges, vaccines, and plain clean surroundings, the shepherd can maintain a relatively clean flock free from most parasites and diseases.

Sheep diseases fall into four general classes: external parasites, internal parasites, contagious diseases, and noninfectious ailments. Dips and sprays when properly used will control the external parasites. Vermifuges may be used to keep the flock free from internal parasites. Contagious diseases usually need the attention of a veterinarian, while most noninfectious ailments may be controlled by disinfectants and good sanitation.

PROGRAM OF SANITATION AND MANAGEMENT

The following steps are important in keeping the flock healthy:

1. Clean and disinfect all lambing pens before the ewes lamb.
2. Clip all tags and other filth from the ewe before putting her in the lambing pen.
3. Disinfect the navel of newborn lambs with a tincture of iodine.
4. Drain yards and lots well, and keep as free of mud as possible.
5. Rotate pastures often.
6. Use recommended treatments for internal parasite control.
7. Use recommended sprays and dips for the control of external parasites.
8. Vaccinate for diseases for which successfull vaccines exist.
9. Treat open wounds with recommended smears and disinfectants.
10. Avoid overcrowding of the flock.

FIGURE 257. *A permanent-type dipping vat.* *(Courtesy Michigan State College.)*

11. Force the breeding flock to get plenty of exercise.
12. Isolate all animals known to have infectious diseases.
13. Feed rations that are well balanced in essential nutrients.
14. Observe carefully the flock often for signs of diseases and parasites.

CONTROL OF EXTERNAL PARASITES

External parasites may be controlled by a rigid dipping or spraying program.

Ticks and Lice. *Symptom.* Ticks and lice are tiny insects which produce irritation by sucking the blood from the animals. Sheep will rub against almost any object to relieve the itching. Animals infested with lice or ticks lose vitality and fail to grow and reproduce well.

Prevention. Dipping or spraying the flock once or twice a year will control lice and ticks. Usually if the ewes are dipped in the fall before lambing, the flock may be kept free of the parasites by one treatment per year. Any good sheep-dip will do the job, but D. D. T. is cheaper and has been very effective. Use 8 pounds of 50 per cent wettable D. D. T. powder and 2 pounds of a wetting agent (Dreft, Vel, Tide, and so forth) per 100 gallons of water. Spray the animals thoroughly, using at least 70 pounds of pressure. If a dipping vat is available, the animals may be dipped. Dipping insures complete coverage but results in some unused dip being left over.

If animals are to be treated during cold weather, apply about

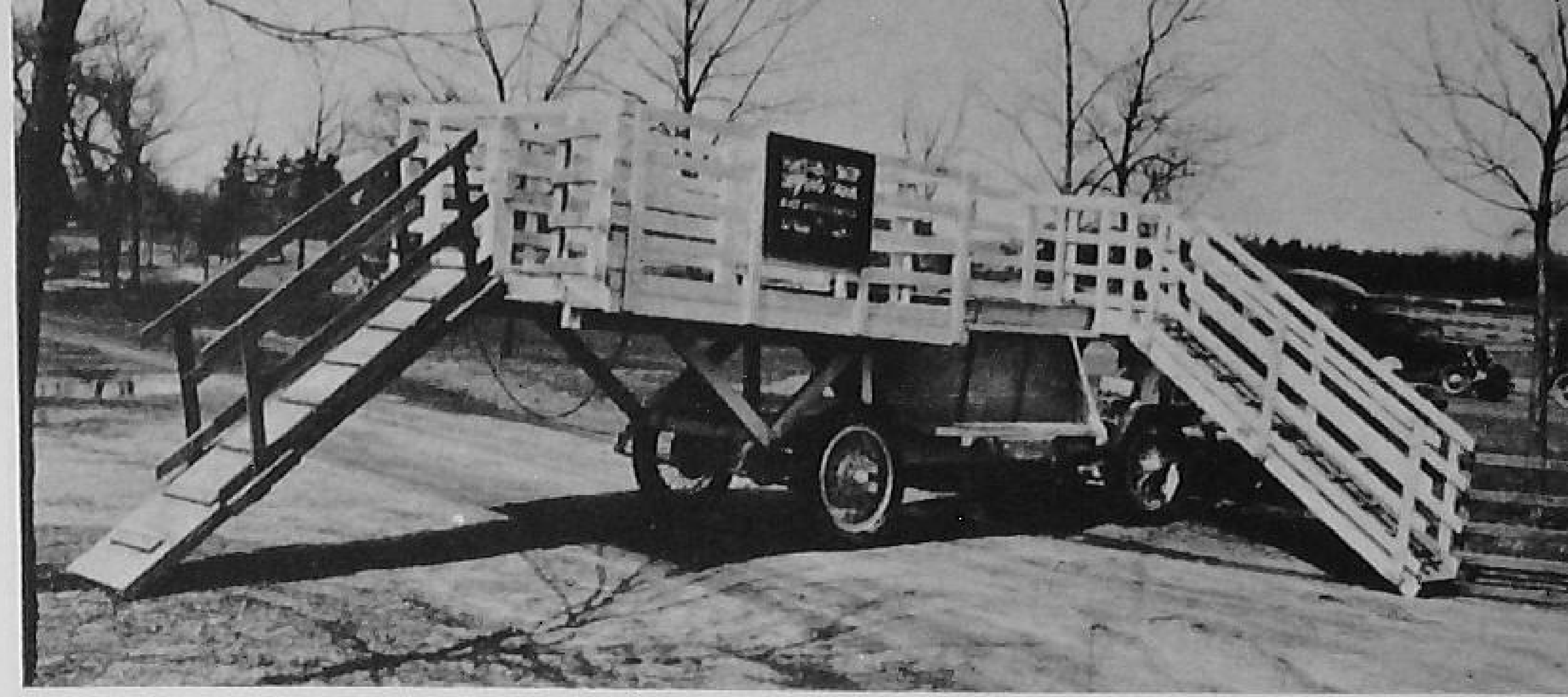


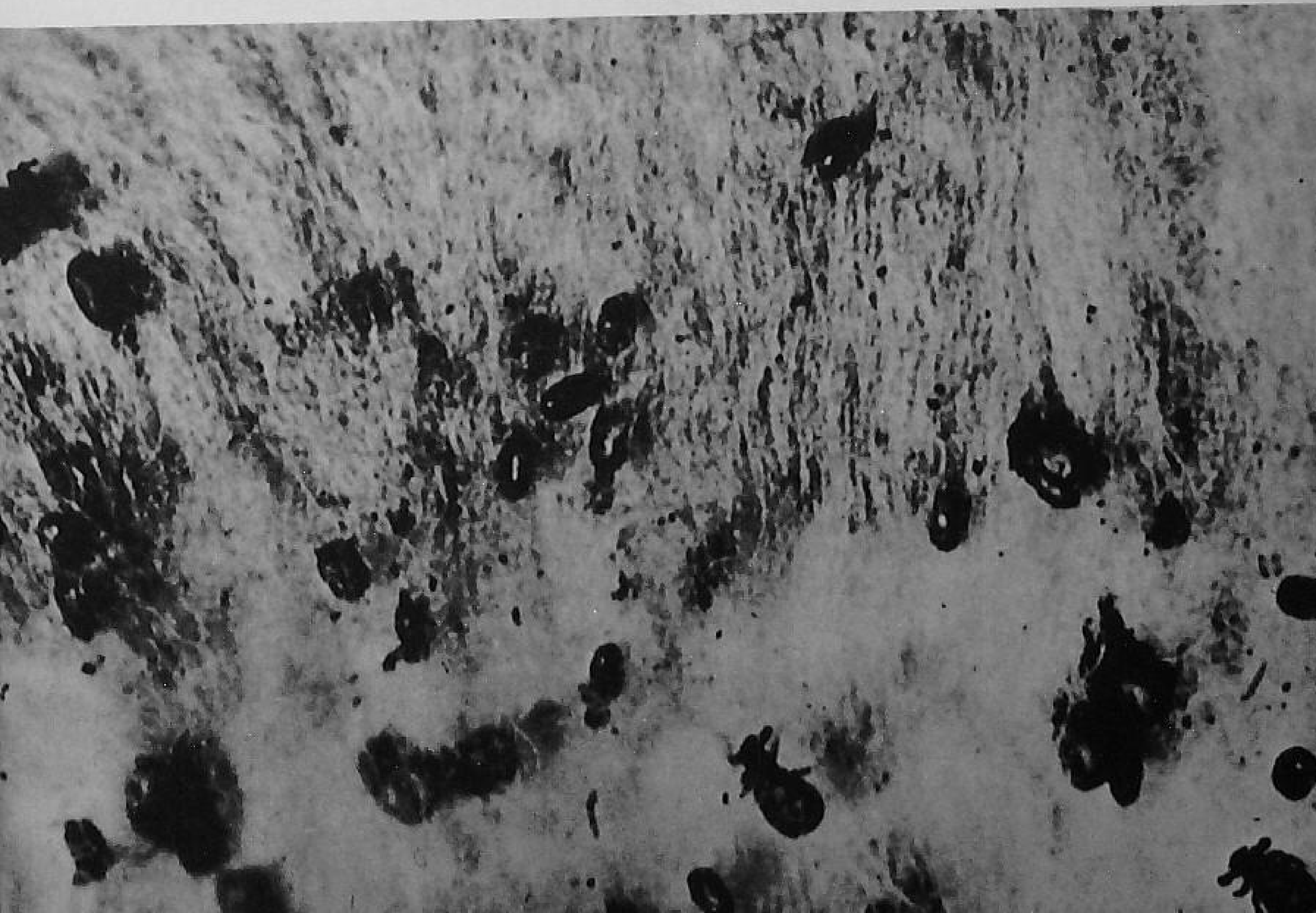
FIGURE 258. *Portable dipping vat. This type may be owned cooperatively by several farmers and transported from farm to farm. (Courtesy Michigan State College.)*

5 ounces of a 10 per cent D. D. T. dust per animal followed by a second treatment in about fourteen days.

Mites. Mites produce what is known as scab of sheep. There are two types—one that burrows beneath the skin and one that feeds by biting the skin.

Symptoms. The mite produces an irritation causing itching which the animals try to relieve by rubbing. Scabs form on the

FIGURE 259. *Ticks in the wool of a lamb. (Courtesy U.S.D.A. Bureau of Animal Industry.)*



skin causing loss of wool, and very often other types of infections set in.

Prevention. A veterinarian should be called if scab is suspected. The parasites may be controlled by dipping in a solution of lime-sulphur. Four or more dippings are necessary at intervals of six to seven days. The mixture may be made by using 4 gallons of liquid lime-sulphur in 50 gallons of water. A single application of benzene hexachloride or lindane spray applied thoroughly at 100 to 200 pounds pressure will give control of the mange mite. The dip or spray solution is made by mixing 8 pounds of 25 per cent lindane wettable powder or 16 pounds of 12 per cent gamma benzene hexachloride and 2 pounds of wetting agent in 100 gallons of water.

Screw Worm. Open wounds are invitations for the screw worm fly. The eggs are laid near the wound. The young hatch and attack living tissue, causing death in many cases.

Prevention. Applying any of the recommended smears EQ335, 82, or 62 to open wounds will prevent screw worm infestation. The smears may be purchased from any dealer that sells livestock remedies.

Blow Flies. Maggots that hatch from the eggs deposited by blow flies often appear around the rump or dock where filth accumu-

FIGURE 260. *Sheep with scab. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

FIGURE 261. *Lamb suffering from the maggots of blow flies. (Bailey photo. Reprinted from* Successful Farming.)

lates. They do not cause death directly but secondary infection may develop which may cause death.

Prevention. Use the same treatment described for screw worms after having clipped the wool from the affected areas and having cleaned the wounds. Docking lambs and tagging ewes will eliminate much of the filth that attracts blow flies.

INTERNAL PARASITES

Stomach Worms. The stomach worm is one of the most common forms of internal parasites that cause losses in sheep. The female lays eggs which pass out of the body with the feces. The young hatch and crawl up on the blades of grass where they are swallowed by sheep during grazing. The tiny worms travel to the abomasum where they grow, and the cycle is repeated.

Symptoms. Infested sheep become listless, thin, weak, and unthrifty. When infestation is heavy, a swelling may develop under the jaw, and is known as "bottle jaw."

Prevention. Since the tiny worms that appear on the blades of grass are dependent upon a host for survival, the rotation of pastures every two weeks will help to control the common stomach worm.

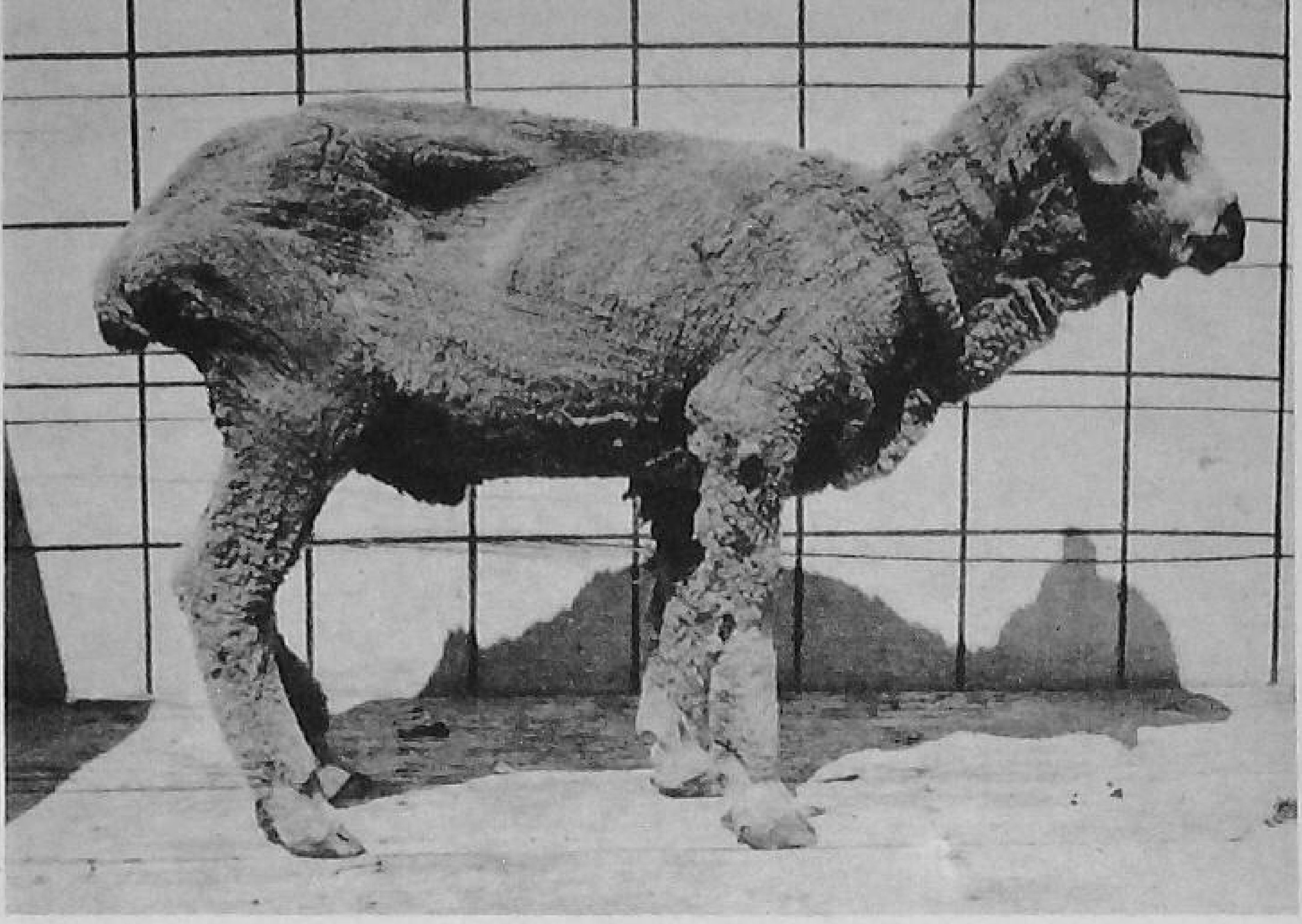


FIGURE 262. *Sheep infested with stomach worms. (Courtesy University of Illinois.)*

Regular drenching of the animals with a recommended vermifuge and maintaining a salt phenothiazine mixture free choice will keep the common stomach worms under control.

The cheapest drench is a copper sulfate-nicotine sulfate solution, which may be purchased from any dealer who handles livestock medication, or mixed as follows: Dissolve 2 ounces of blue stone in one gallon of hot water. Mix thoroughly, using glass, crockery, or enamel containers. Just before using, add 1 ounce of Black Leaf 40 to each gallon of blue stone solution. Keep the sheep off feed for at least twelve hours before and six hours after treatment. Give lambs up to 50 pounds, ½ to 1 ounce; from 50 to 80 pounds, 2 ounces. Give sheep weighing 80 pounds or more, 3 to 4 ounces. Phenothiazine, while more expensive, is generally recognized as being more effective, not only against the common stomach worm, but certain other internal parasites. By using the phenothiazine-lead arsenate compound, prepared for sheep, the nodular worm also is controlled.

A complete control program should include fall and spring treatment, using either the blue stone or 1 ounce of phenothiazine for mature animals and ½ ounce for lambs. Phenothiazine may be given in a capsule or as a drench. A mixture of 1 part phenothiazine by weight and 10 parts salt by weight should be given free choice. Recommended treatments and the rotation of pastures will result in good parasite control.

Drenches may be given with a bottle or a syringe. Care should be used not to get any of the mixture into the lungs. The head should be held in a natural position (not too high) and the drench given slowly, allowing time to swallow.

Other Species of Stomach and Intestinal Worms. There are several other types of stomach and intestinal worms that attack sheep in addition to the common stomach worm that has been described. The more important ones are: brown stomach worm, small stomach worm, cooperias, nodular worm, and hookworm. The symptoms, control, and treatment are the same as for the common stomach worm.

Broad Tapeworm. The broad tapeworm in the sheep has a head which might be likened to an anchor. To the head are attached the segments of the tapeworm. Each segment is much like an individual worm as it is capable of producing eggs. The segments at the end break off, and may be seen in the manure as white flecks. These segments contain eggs which are ingested by soil mites where they develop into the secondary stage. The mites crawl up on the blades of grass where the sheep swallow them while grazing, and thus become infested with the tapeworm larvae.

Symptoms. Sheep infested with tapeworm show an unthrifty condition characteristic of stomach worms and other internal parasite infestation.

Prevention. The prevention and control measures are similar to

FIGURE 263. *(left) The wrong way to drench a sheep. The head is held too high. The liquid may be forced into the lungs, causing strangulation. (Courtesy Geo. A. Hormel & Co.)*

FIGURE 264. *(center) The correct position in which to hold a sheep when drenching. (Courtesy Geo. A. Hormel & Co.)*

FIGURE 265. *(right) The drenching syringe makes it easy to drench sheep. (Courtesy Michigan State College.)*

those of the common stomach worm. Treatment for tapeworms is less effective than for stomach worms, but the blue stone nicotine sulphate drench is fairly effective.

Gid Tapeworm. In the droppings of dogs, wolves, coyotes, or other carnivorous animals are found the larvae of the gid tapeworm. These droppings distribute the eggs where sheep run. The eggs are taken in through the mouth, hatch, and enter the bloodstream. Some of the worms reach the spinal cord and brain, causing death.

Symptoms. Sheep affected with gid stagger around in a circle, show dullness and loss of appetite, and finally die.

Prevention. There is no known cure. Keeping dogs and similar animals away from the flock will help to prevent infection.

Lungworms. Lungworms are found in the lungs of the sheep. They are more prevalent during wet seasons.

Symptoms. Coughing, loss of appetite, diarrhea, and weakness are the common symptoms.

Prevention. There is no known cure, but the frequent rotation

FIGURE 266. *Sheep with gid tapeworm. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

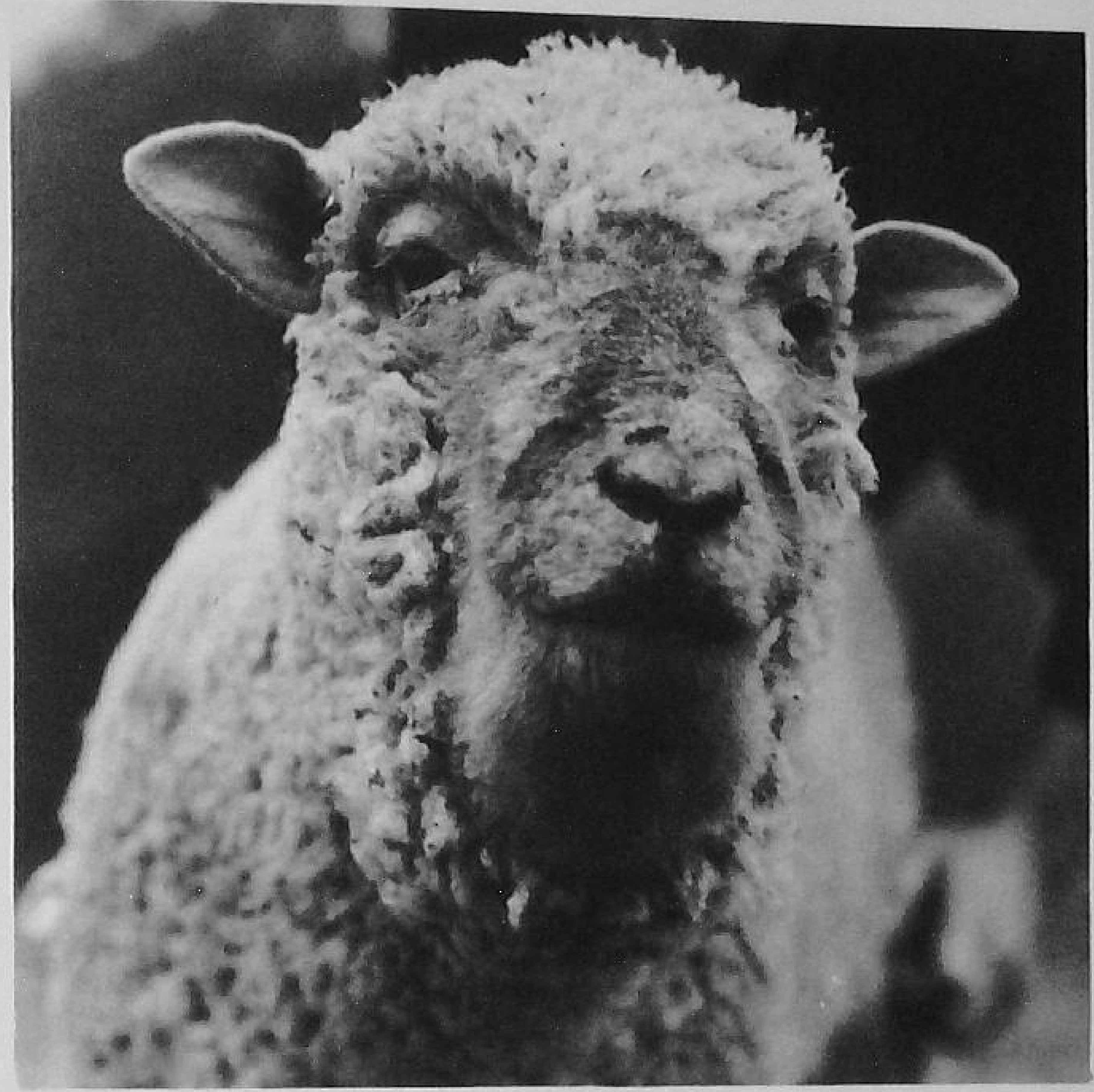


FIGURE 267. *Bottle jaw. The result of heavy infestation with internal parasites. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

of pastures will help to hold down the lungworm population.

Grub in the Head. The sheep bot deposits larvae in the nostrils of the sheep. These larvae crawl up into the nose causing irritation and catarrh.

Symptoms. The common term used by sheepmen for the condition produced by the bot is "snotty nose." The nose runs, and the sheep keeps up a continuous snuffing. Infested sheep stand with their noses near the ground or lie down, sneeze, and seem very excited.

Prevention. Tar the noses of the sheep or apply some noninjurious repellent to the nose during the bot season as a preventative. Provide a shade or darkened place where bots are less likely to be found. A 3 per cent saponified cresol solution sprayed under a 38-pound pressure into the nasal cavity has proved quite effective in killing the small larvae.

Coccidiosis. Coccidiosis is a parasitic disease caused by tiny organisms that live in the intestinal lining. Infested animals pass

hundreds of the organisms in the feces, which are picked up by other animals.

Symptoms. Lambs are more likely to be affected than older sheep. Severe diarrhea that is often bloody is the most common symptom. Animals become weak, lose their appetite, and often die. Sanitation and segregation of affected animals are the best control measure. Treatment should be placed in the hands of a veterinarian.

INFECTIOUS DISEASES

Sore Mouth. Sore mouth is essentially a disease of lambs caused by a virus that will live throughout the winter. The disease is transmissible to man, so care should be used in treating infected animals.

Symptoms. Infected animals appear depressed, and refuse to eat. An examination will show sores on the lips, gums, and tongue.

Prevention. Immunization with a vaccine will give a relatively high immunity. Treatment consists of isolating and treating infected animals with a 2 per cent potassium permanganate solution.

Overeating disease. Overeating disease is probably responsible for a greater loss of fattening lambs than any other single ailment. The disease is thought by many to be caused by an organism found in the soil that produces a toxin or form of poisoning. Lambs on full feed of grains seem to be more susceptible to the disease than other sheep or lambs.

FIGURE 268. *Sheep with sore mouth. (Courtesy U.S.D.A. Bureau of Animal Industry.)*

Symptoms. The affected animals go off feed and develop a diarrhea. Many animals show staggering or convulsions. The animals affected usually die within a short time after the first symptoms appear. The disease is common to lambs in the fattening yards where they are on full feed.

Prevention. Vaccinating for the disease has proved to be quite effective as a preventive measure. The feeding of sulphur at a rate of ¼ to ⅓ ounce per lamb per day has helped prevent the disease, but lowers the feed intake and slows the gain.

Brucellosis, or Bangs. Brucellosis is caused by an organism similar to the germ which causes the same disease in cattle and swine. The disease may travel from an infected animal to a healthy one as a result of close contact of the animals.

Symptoms. Aborted fetuses, retained afterbirth, lowered milk production, arthritis, and mastitis may develop when animals are infected with the disease.

Prevention. Prevention consists largely of blood testing for the disease to eliminate reactors from the flock, insisting on replacement animals being tested, and applying sanitation measures to prevent the spread of the disease. While the organisms that cause the disease in cattle, swine, sheep, and goats are of different types, man is susceptible to all of them. Care in handling the ewes at lambing time, especially their afterbirth and newborn lambs, should be exercised to prevent contracting undulant fever by the shepherd.

Tuberculosis. Tuberculosis is declining among all types of livestock in the United States as a result of a rigid control program that is nationwide in scope.

Symptoms. Tuberculosis is very difficult to diagnose from outward symptoms. The gradual loss of weight and weakening condition are the most pronounced outward symptoms. If the disease is suspected a veterinarian should be called who will undoubtedly kill and make an internal examination of an infected animal to determine the cause.

Prevention. The elimination of unthrifty animals suspected of having tuberculosis and good management are the best preventive measures.

Anthrax. Anthrax is an infectious disease that usually runs a rather short course and occurs in scattered outbreaks. The disease usually proves fatal.

Symptoms. The rather sudden death of animals that appeared

healthy only a short time before is the most pronounced symptom of anthrax. Infected animals will show muscular weakness, loss of appetite, and high temperature. Bloody feces may also be observed.

Prevention. The only successful prevention is to vaccinate. In areas where anthrax outbreaks are common vaccination should be part of the regular management program.

Foot and Mouth Disease. This is a highly contagious disease of sheep, swine, and cattle. So far, the disease is not present in the United States, but every precaution will be necessary if it is to be kept outside of our boundaries.

Symptoms. The disease is characterized by blisters found on the tongue, lips, cheeks, and skin around the claws of the feet. The animals infected have a heavy flow of saliva which hangs from the lips in strings. Death losses are not generally high, but the economic value of infected animals is considerably reduced.

Prevention. Prevention consists of the elimination of all infected animals by slaughtering and burning or burying. If the disease is suspected, the government authorities should be notified. The foot and mouth disease virus is quickly destroyed by a solution of lye. The use of lye solution for cleaning quarters where infected animals have been will destroy the virus if the area is properly and thoroughly disinfected. A new vaccine has been developed which is being recommended for areas outside of the United States. Unless the disease spreads into this country to a considerable extent, American farmers will not likely be advised to vaccinate. Vaccines have not been regarded as favorable to complete eradication, therefore they have not been used in this country.

Foot Rot. Foot rot is an infection of the feet of sheep and may affect other types of livestock. The infectious foot rot should be distinguished from ordinary sore feet. Usually if one animal develops foot rot, others will become infected.

Symptoms. Common symptoms are lameness, and upon examination of the foot a foul odor will be noticed.

Prevention. Isolate and treat infected animals. Clean the infected area of the foot and disinfect with a lysol or a 1 per cent blue stone solution. If improvement isn't noticed within a short time after treatment, a veterinarian should be consulted.

Lamb Dysentery. This is a disease due to dark, filthy, damp housing conditions. The disease develops in lambs twelve to forty-eight hours old and seldom affects older lambs.

Symptoms. Diarrhea and high death rate in newborn lambs are the most common symptoms.

Prevention. Sanitation and ventilation in the lambing pens will prevent most cases of lamb dysentery.

Stiff Lamb Disease. Stiff lamb disease is caused by an infection which enters through the navel cord of newborn lambs.

Symptoms. Stiff sore lambs showing crippling arthritis are the common symptoms of the disease.

Prevention. Prevention lies in clean housing, and in disinfecting the navel cord with a tincture of iodine right after birth.

Pregnancy Disease. Pregnancy disease attacks ewes shortly before lambing usually during the fourth month of gestation. Ewes carrying twin lambs are more susceptible than those with single lambs. The disease is thought to be due to a nutritional deficiency, especially sugar, and lack of exercise.

Symptoms. Ewes will often develop a highly nervous condition followed by paralysis, coma, and death. In the early stages they tend to lag behind the flock and appear to be stiff. The head is held upwards; the neck is stiff; and blindness may occur.

Prevention. Ewes receiving good roughage and ½ pound of shelled corn daily (in the last six weeks of pregnancy) and getting plenty of exercise are seldom affected. Some shepherds feed 1 pint of molasses per head daily the last six weeks of pregnancy.

Bloat. Bloat is caused by rapid fermentation of feeds and the production of excess gas in the rumen. Legume pasture is especially dangerous as a bloat-producing feed unless mixed with grasses.

Prevention. Avoid straight legume pastures and overfeeding on grains. Bloated animals may be helped by drenching with ¼ pint of mineral oil. If the animals are to the place where quick relief is necessary, a trocar inserted 3 inches in front and a little below the hip bone will relieve the condition.

SUMMARY

The prevention of sheep diseases is largely one of sanitation, proper feeding, and general good management. For the common ailments that may be prevented by vaccines, a program of vaccination is recommended. Overeating disease and anthrax are examples of diseases that may be prevented by vaccination.

The use of proper sprays or dips at least once a year are essential for the control of external parasites, such as ticks. Internal

parasites may be controlled through pasture rotation and drenching with a recommended vermifuge, such as phenothiazene.

Disinfecting the navel of newborn lambs and clean, dry well-lighted and ventilated lambing pens will prevent most diseases of newborn lambs.

Bangs disease can be controlled by testing and eliminating reactors from the flock. Open wounds should be treated with one of the recommended smears if they occur during the screw worm season.

Lambs should be docked and ewes tagged to prevent a collection of filth that will attract blow flies and result in maggot infestation.

QUESTIONS

1. Give the steps in a management program that will help to prevent sheep diseases.
2. Which of these steps do you apply to your flock?
3. Give the treatments recommended for external parasites.
4. What are the recommended control measures for internal parasites?
5. Which diseases may be prevented by vaccination?
6. How can most small lamb diseases be prevented?
7. What is the most common disease of fattening lambs, and what are the preventive measures?
8. What is the cause and prevention of pregnancy disease?
9. What is the cause and treatment for bloat?
10. How can Bangs disease be eliminated from the flock?

REFERENCES

Elder, Cecil, and Rodabaugh, Donald E., *Internal Parasites of Sheep*, University of Missouri, Columbia, Missouri, Agricultural Experiment Station Bulletin 527.

Gunderson, Harold, *Controlling Livestock Pests*, Iowa State College, Ames, Iowa, Extension Service Pamphlet 132.

McDonald, C. W., *Lamb Production*, Iowa State College, Ames, Iowa, Extension Service Bulletin P107.

Prier, J. E, *Disease Prevention In Young Livestock*, University of Wyoming, Laramie, Wyoming, Agricultural Experiment Station Circular 47.

Ryff, J. F., and Honess, Ralph F., *Internal Parasites of Sheep*, University of Wyoming, Laramie, Wyoming, Agricultural Experiment Station Circular 42.

< 28 >

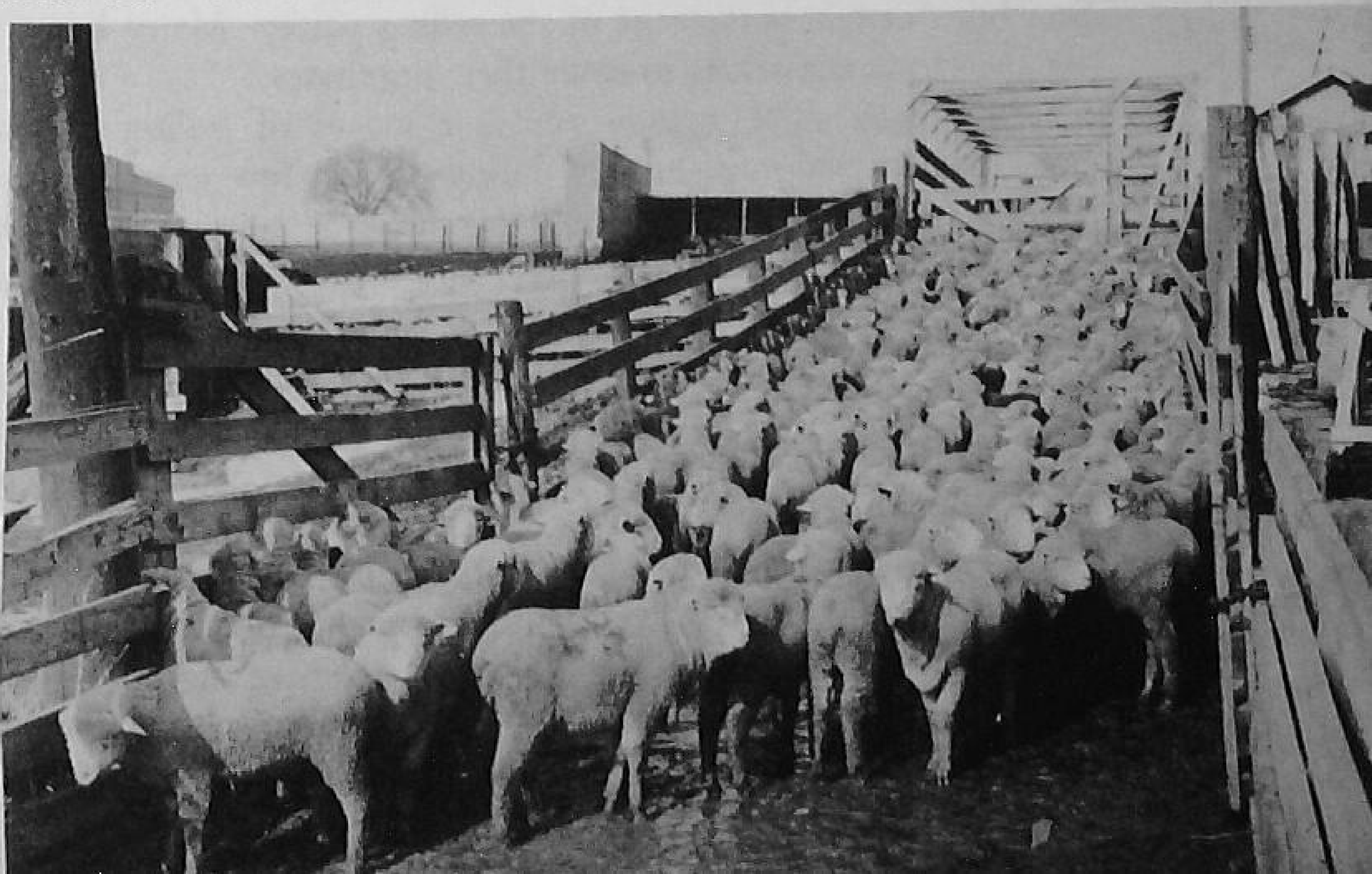
Marketing Sheep and Wool

The net price received for the sheepman's products is important in determining the profits he will make from the enterprise. The time and methods he selects for marketing his sheep and wool will have an important effect upon the net returns. Most sheepmen will have lambs and wool as a source of income. The lambs may be sold as feeders or slaughter lambs, depending upon the area and general conditions under which they are produced. The purebred producer will rely mostly upon the sale of breeding animals for his income; however, wool will constitute an important secondary source of returns.

MARKETING FEEDER LAMBS

A large percentage of all lambs produced are sold as fat or slaughter lambs. However, in certain range areas where the amount and quality of the forage is not sufficient to produce grass-

FIGURE 269. *Feeder lambs at a central market. (Courtesy Rath Packing Company.)*



fat lambs, the producers sell them as feeder lambs.

Feeder lambs are usually marketed by the following methods: (1) private sale directly by producer to feeder, (2) through a dealer, (3) through a commission firm at a terminal market, and (4) auction sale.

Direct Selling. Lamb feeders who are big operators and are feeding several hundred lambs per year often desire to buy directly from the producer. This type of buying eliminates the profits and commissions that have to be paid the middleman and may result in a higher price to the producer and in some saving to the buyer. Sometimes the dealer and buyer enter into a contract several weeks or even months in advance of the delivery date. The contract states the sale price, place of weighing, shrinkage to be allowed, and date of delivery. Contract selling of sheep is not as common a practice as it is with feeder cattle. Unless the buyer wishes to purchase large numbers, he probably cannot afford the time required to contact the producers and make his selection.

Selling Through a Dealer. There are many dealers who make a practice of buying feeder lambs, either on a commission basis or by reselling them to the feeders at a profit. Some of the packing plants have made a practice of buying feeders and reselling them to their customers at cost as a service to local feeders. The buyer who wishes to purchase only a relatively small number often relies on a dealer to fulfill his requirements.

Terminal Markets. Lambs may be shipped or trucked to the terminal markets where a commission firm will feed, sort, and sell them for a certain percentage of the selling price. Many buyers visit the terminal markets to make their purchases.

Auction Sale. The auction sale as a means of selling feeder lambs has increased in popularity during the last few years. Most auctions are organized to sell on a per head or commission basis and are used as a place where buyer and seller can get together. Of course, the animals go to the highest bidder.

Factors to Consider in Selecting a Method of Marketing. There is no one best way of marketing feeder lambs that will apply to all conditions. The producer should consider the expense, prices paid, commissions, season, shrinkage, and time involved in selling. Direct selling from the ranch eliminates most of the death loss and shrinkage. Less time is usually required by the producer in marketing direct. However, he must have sufficient numbers and

TABLE 42

MARKET CLASSES AND GRADES OF SLAUGHTER SHEEP

Sheep or Lambs	*Sex*	*Age*	*Weight*	*Pounds*	*Grade*
SHEEP	Ewes	Yearlings	Light	90 down	Prime, choice, good, utility, cull.
			Medium	90 to 100	
			Heavy	100 up	
		Mature	Light	120 down	Choice, good, utility, cull.
			Medium	120–140	
			Heavy	140 up	
	Wethers	Yearlings	Light	100 down	Prime, choice, good, utility, cull.
			Medium	100–110	
			Heavy	110 up	
		Mature	Light	115 down	Choice, good, utility, cull.
			Medium	115–130	
			Heavy	130 up	
	Rams	Yearlings	All weights		Choice, good, utility, cull.
		Mature	All weights		Choice, good, utility, cull.
LAMBS	Ewes, wethers, rams	Hothouse		60 down	Prime, choice, good, utility, cull.
	Ewes, wethers, rams	Spring lambs	Light	70 down	Prime, choice, good, utility, cull.
			Medium	70–90	
			Heavy	90 up	
	Ewes, wethers, rams	Lambs	Light	75 down	Prime, choice, good, utility, cull.
			Medium	75–95	
			Heavy	95 up	

quality of lambs to attract the buyers. The small producer may find his best market through the auction or the terminal markets. Whenever lambs are moved over considerable distance, both shrinkage and death losses have to be considered. Shrinkage will run from 3 to 8 per cent, depending upon the distance shipped and methods of handling.

Season. Most lamb feeders like to purchase lambs during the fall months. They may turn them on fall pasture for a short time and then finish them on grain. As the fall and early winter provide cooler weather which is favorable to the good gains and corresponds to the feed grain harvest, feeder sheep are generally in greater demand during this time of year.

MARKETING SLAUGHTER LAMBS AND SHEEP

Most fat lambs and sheep are sold to the packers to be slaughtered. The producer may sell directly to the packer or his buyer, through a commission firm, or to a private dealer. Slaughter lambs are graded and classified according to age, weight, and finish. Table 42 shows the common classes and grades of slaughter sheep.

Grades and Classes of Slaughter Sheep. Slaughter sheep are those animals intended for immediate slaughter. The price per pound paid for them depends largely upon the value of the dressed animals. Young, well-finished lambs produce the best flavored carcass and generally sell higher per pound than older or poorly finished animals.

Sex. *Ewes.* Ewes are female sheep or lambs.

Wether. A wether is a male lamb that has been castrated before reaching sexual maturity.

Ram. A ram is an uncastrated male sheep of any age.

Age. *Hothouse lambs.* Hothouse lambs are young lambs, usually born in the fall or early winter, that are milk fat, and sold during the Christmas or Easter season. They are usually sold by the time they are three months of age.

Spring lambs. Spring lambs are those that reach the market in the spring as fat lambs weighing from 70 to 90 pounds. These lambs are usually born in the fall, but are older and heavier than typical hothouse lambs.

Lambs. Animals under a year old, that do not classify as spring or hothouse lambs, are considered lambs. When the term *lambs* is used by the packers, it generally designates grass-fat lambs.

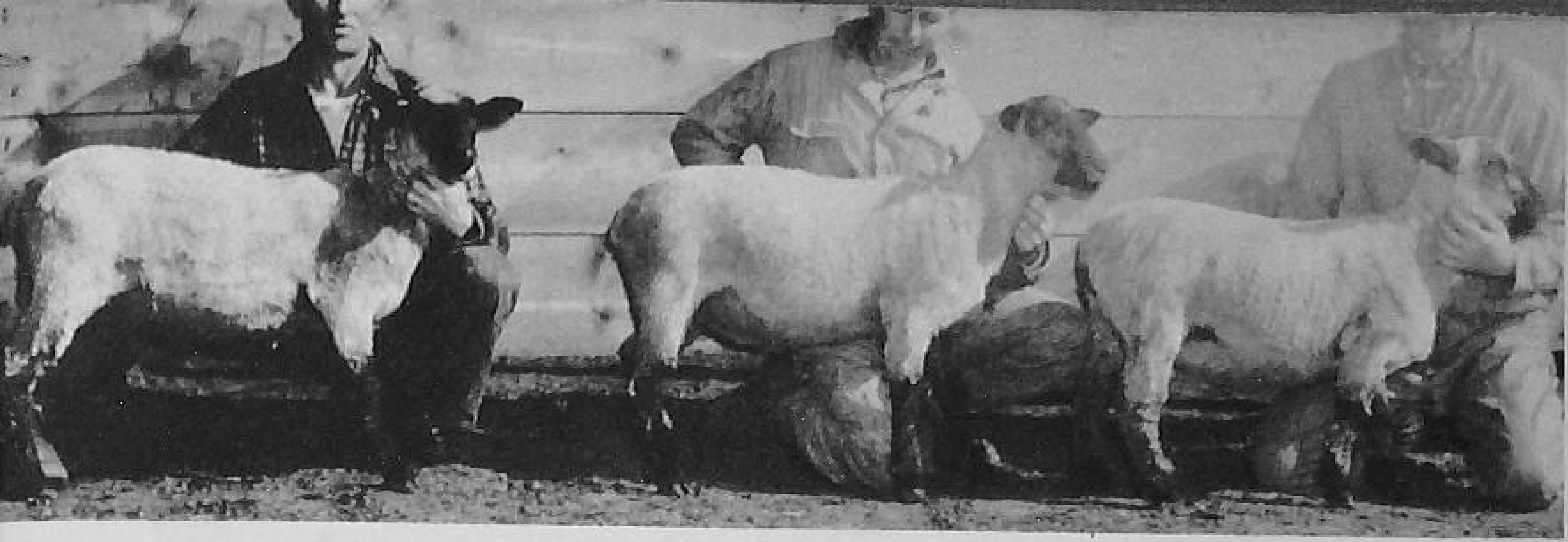


FIGURE 270. *Here are three grades of slaughter lambs. The lambs have been shorn to show their conformation. The lamb on the left graded utility. The center lamb graded good, and the lamb on the right went into the choice grade. (Courtesy Rath Packing Company.)*

Those receiving grain are referred to as fed lambs.

Yearlings. Animals between one and two years of age are classified as yearlings.

Two-year-olds and older. Sheep that are two years old and older are classified as mature, in the slaughter market.

Weight. Slaughter sheep and lambs are classified as heavies, mediums, or lights. The weight divisions are determined by the age.

Grade. Grades are determined by the amount of finish and body conformation. Animals that are low-set, blocky, and well developed in the areas of valuable cuts, such as the back, loin, and leg, are graded prime or choice. Those animals lacking in these qualities are placed in the lower grades. Thin animals with poor body conformation fall into the utility or cull grades.

FACTORS INFLUENCING MARKET PRICE

What makes one person's lambs bring more than another's, even though they are sold at the same market and on the same day, is a

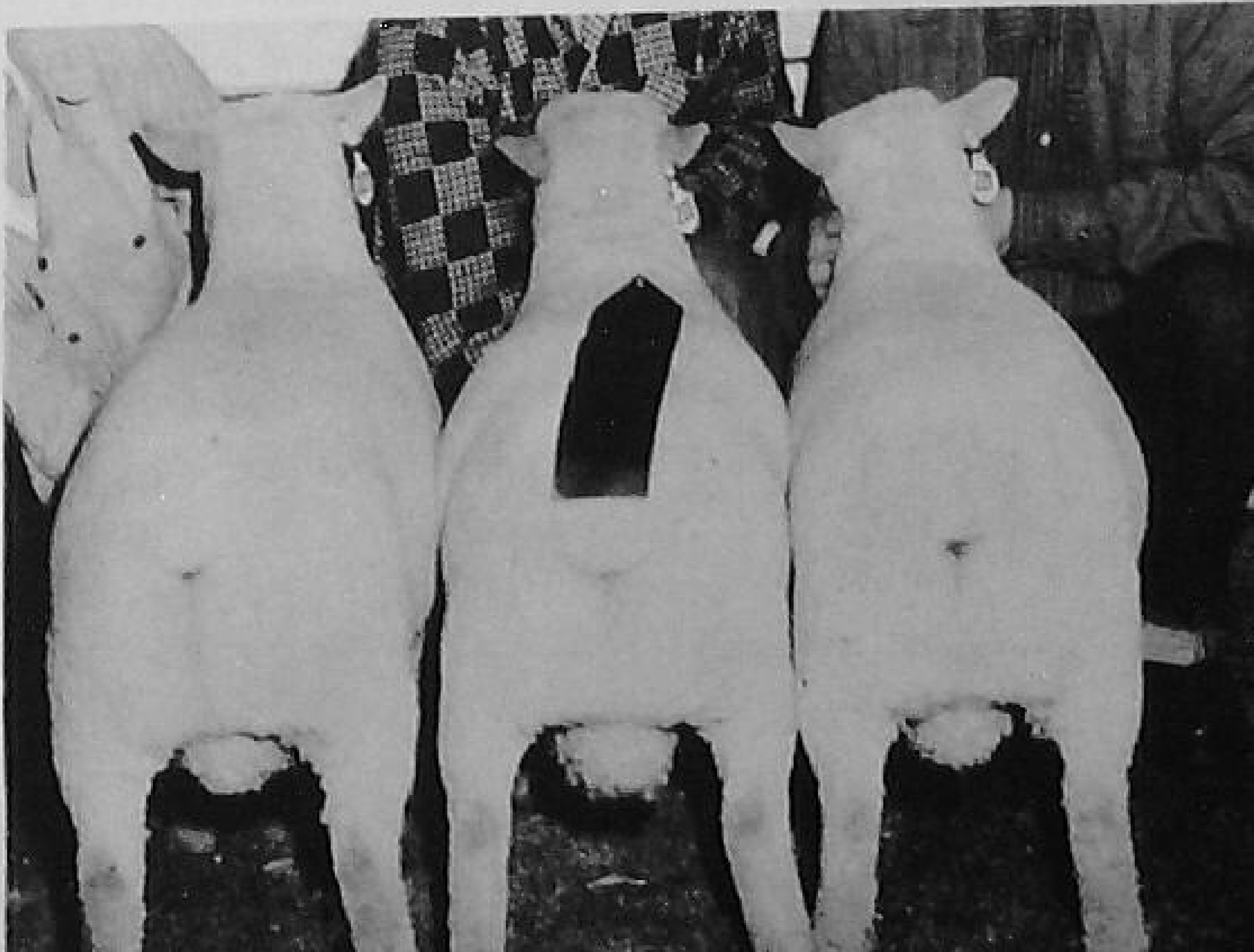


FIGURE 271. *These are top - quality slaughter lambs. They would grade high prime. (Courtesy Rath Packing Company.)*

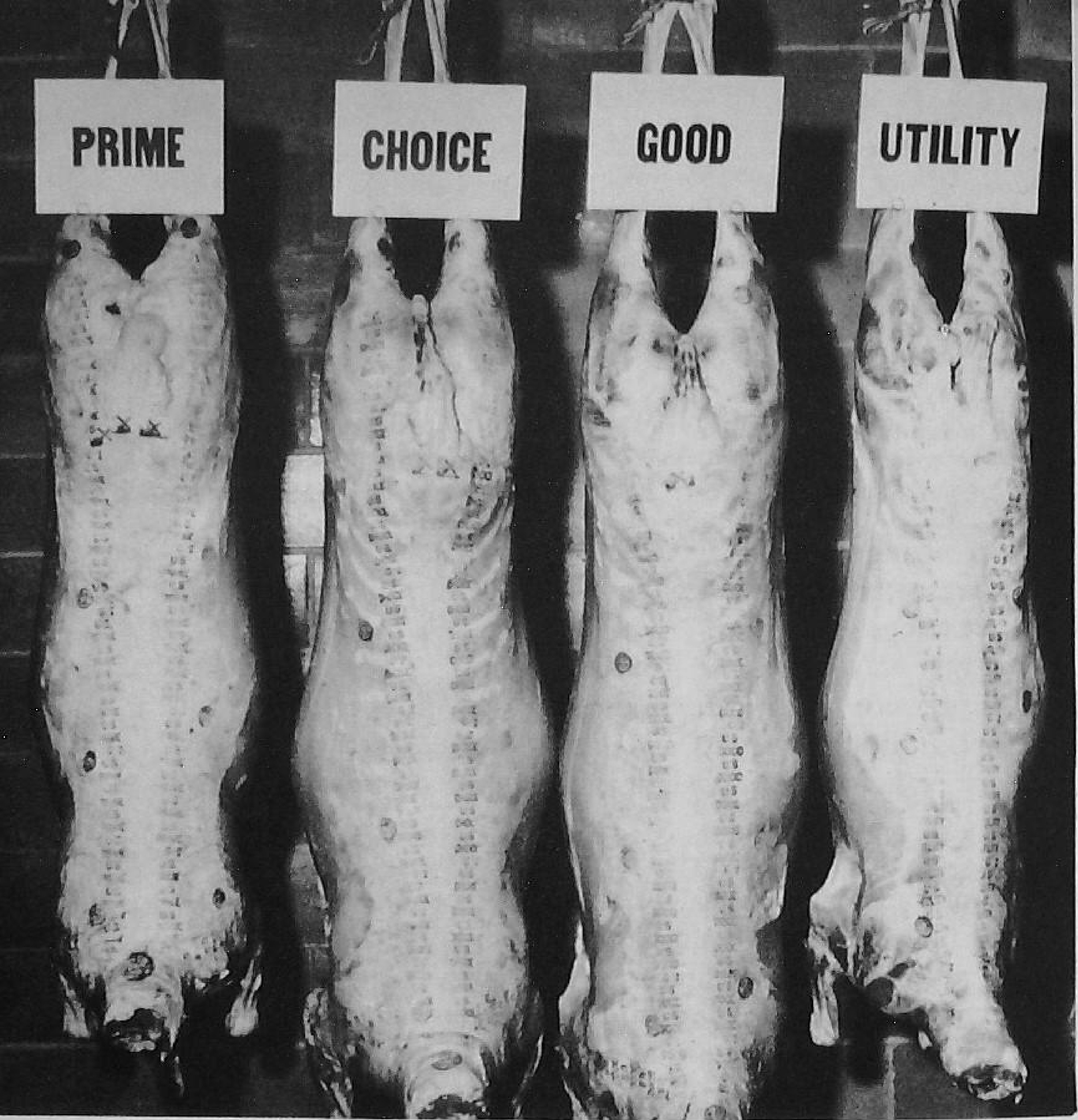


FIGURE 272. *Lamb carcasses representing four grades. (Courtesy Rath Packing Company.)*

question often asked by sheepmen. The packer buyer has learned from experience the quality of carcass that may be expected from a given lot of lambs. The bid he gives will reflect very largely the value of the dressed animal.

Dressing Percentage. When the sheep have been slaughtered, the weight of the carcass divided by the weight of the live animals is called *dressing percentage*. The difference in weight is due to the blood, pelt, feet, head, and viscera which have been removed during slaughter. Sheep and lambs range in dressing percentage from 35 to 65 per cent. Well-finished lambs that are of good mutton type will dress the highest.

The highest price cuts from a lamb come from the leg and loin.

Animals well muscled in the areas of valuable cuts represent a high value to the packer. He is willing to pay a higher price to the producer for quality lambs.

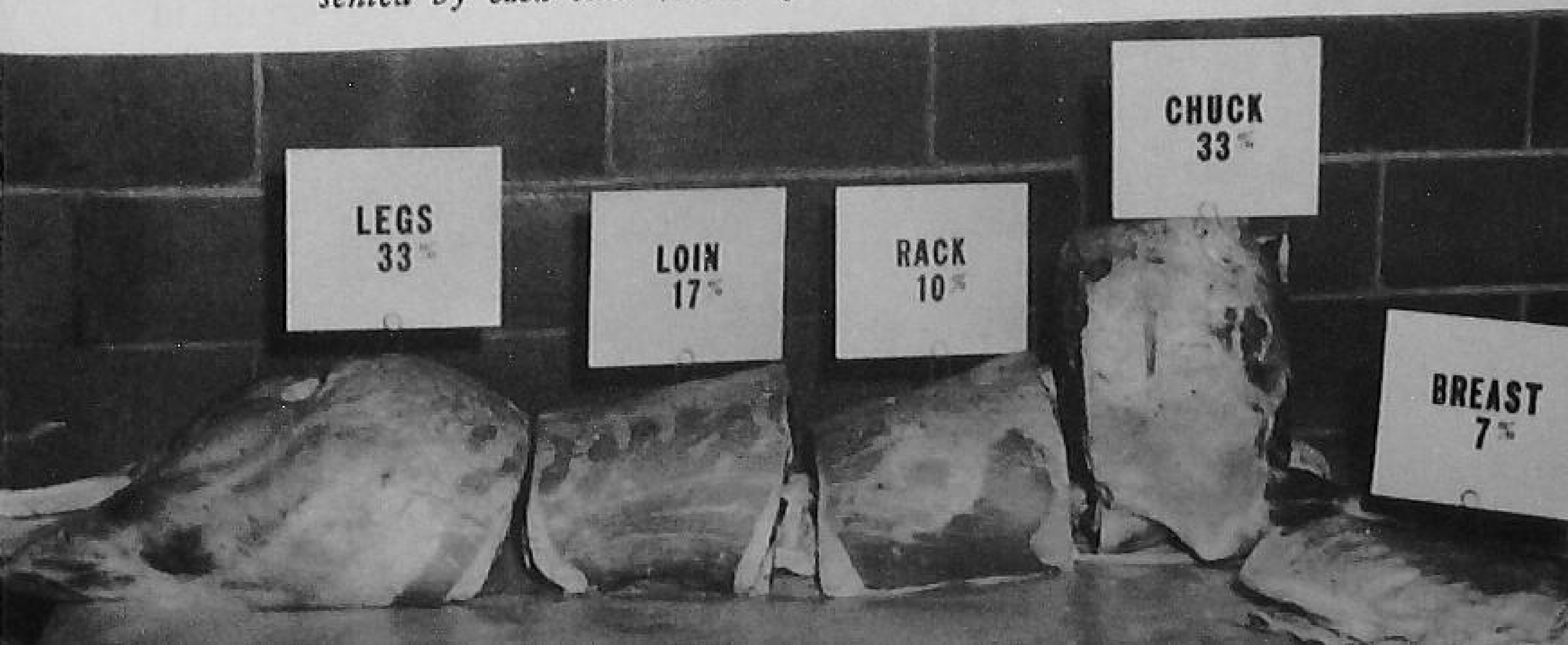
Season. The season that lambs are marketed affects the price received by the producer. Easter lambs usually bring the highest price per pound, followed by spring lambs sold in May or early June. Lambs that cannot be finished for the May or June market should do well in the August market. The arrival of western lambs usually starts in early September and has a depressing effect on the market. Western lambs are usually marketed by early November, and some strengthening may be expected in the market after that date. Fat ewes can be expected to take a decided drop after May 1.

It should be remembered that the net return per dollar spent is the main factor in determining profit. While Easter and May or June lambs will probably bring more per pound, they may not always be the most profitable. These lambs will be born during cold weather, and in the northern areas will not have much pasture. Lambs fed entirely on dry feeds generally cost more per pound to produce. The seasonal market should be balanced against the per pound cost of production when deciding which is more profitable.

MARKETING WOOL

Reject Fleeces. Many factors affect the value of the wool (known as *grease wool*) as it comes off the sheep. Wool that is chaffy, burry, black, or contains tags falls into the reject class and brings a very low price. Wool that has been pulled from a dead sheep, or contains many black fibers, will be put into the reject group. When wool is tied with sisal instead of paper twine, the

FIGURE 273. *The wholesale cuts of lamb and the percentage of the carcass represented by each cut. (Courtesy Rath Packing Company.)*



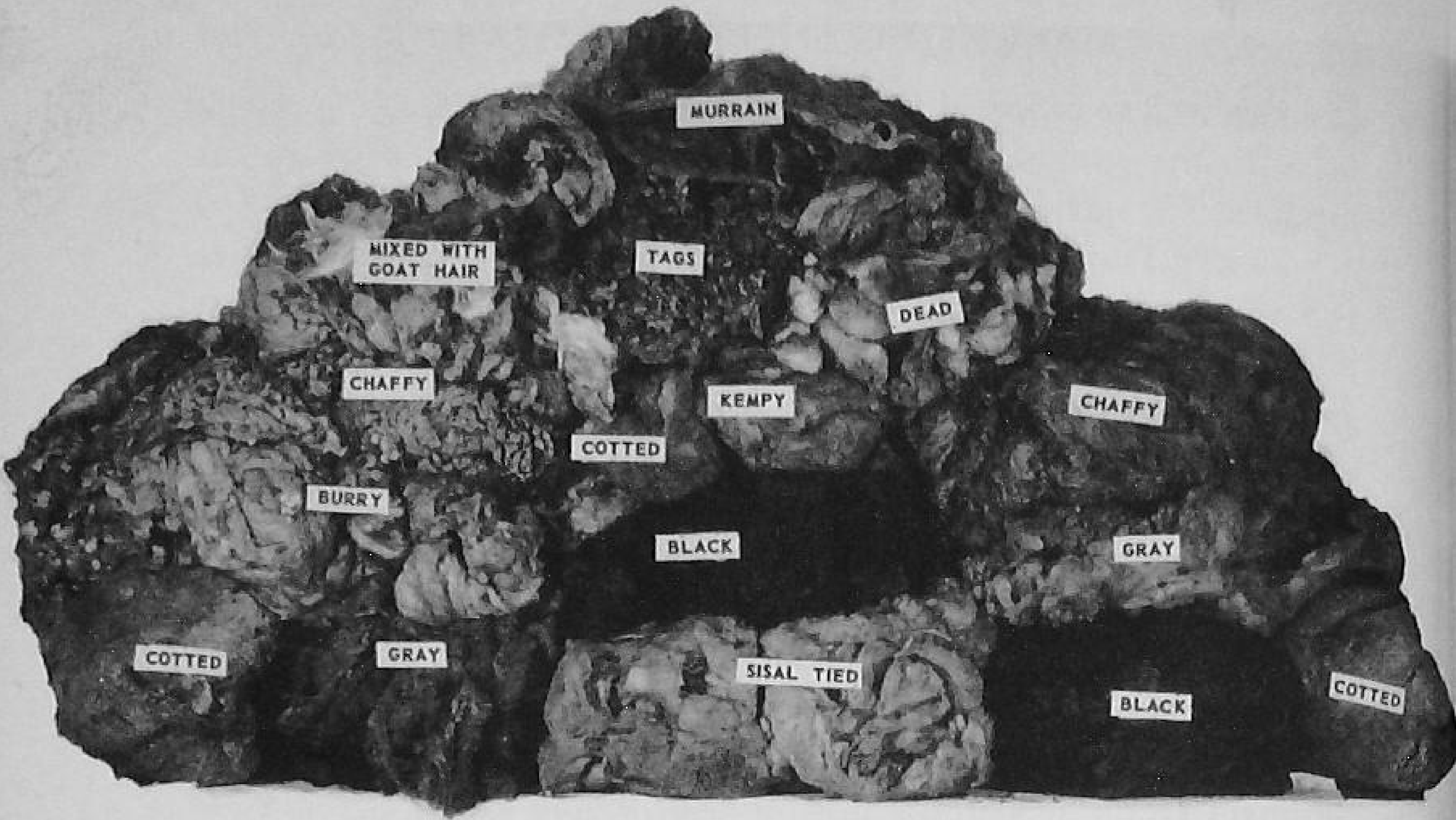


FIGURE 274. *These are reject fleeces showing the reason why they were rejected. (Courtesy U.S.D.A. Bureau of Agricultural Economics.)*

sisal fibers become mixed with the wool and will not come out during the cleaning process. Sisal tied wool will bring a lower price.

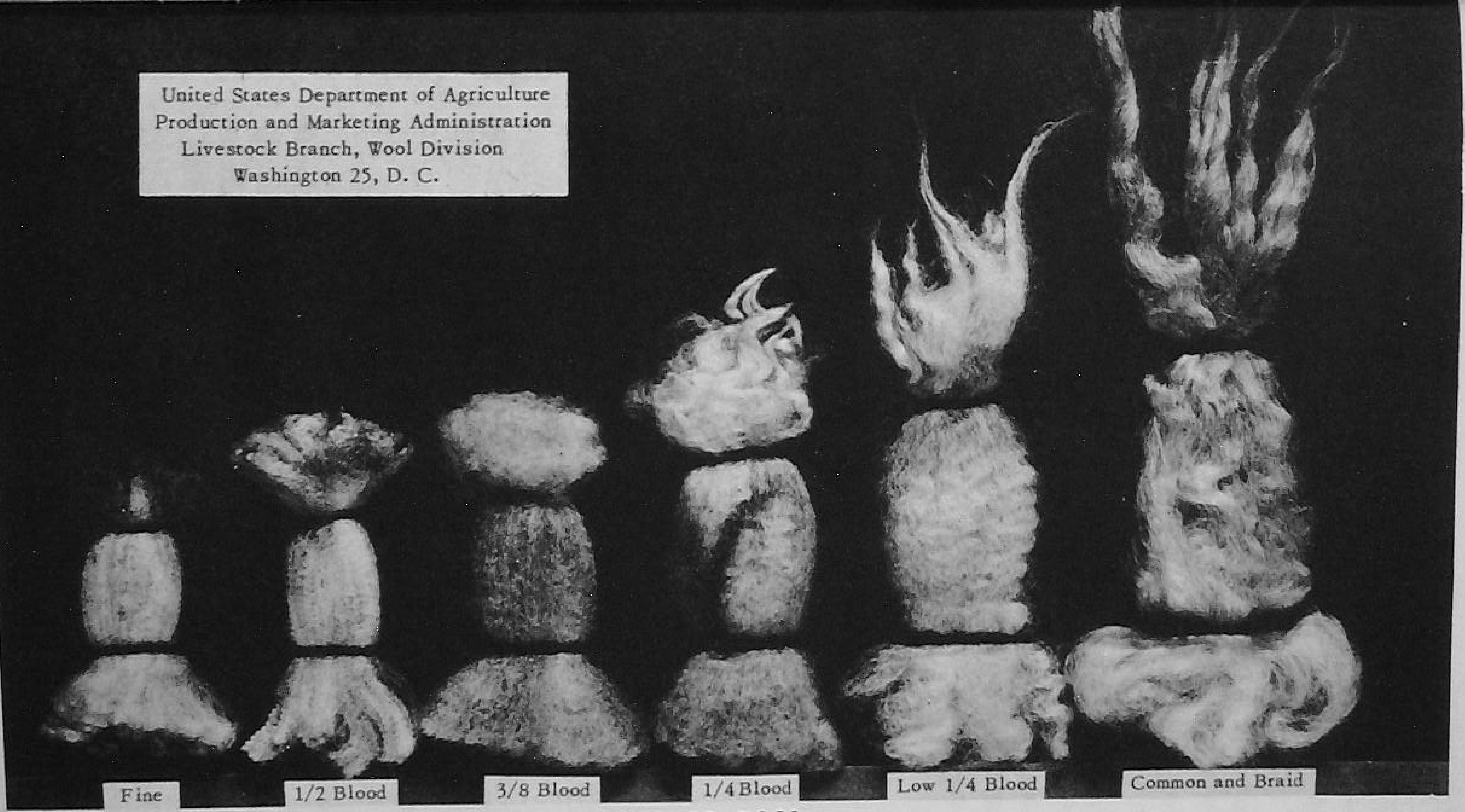
Grades of Wool. Many factors enter into the grades of wool, but the length and diameter of the fiber are the most important. The old method of grading (known as the blood system) was originally based upon the amount of merino blood in the animal producing the fleece. Fleeces from sheep, primarily of merino breeding, were known as *fine*. The other grades were ½ blood, ⅜ blood, ¼ blood, low ¼ blood, common, and braid.

Wool Quality System. The new method of grading divides all wool into twelve grades, and each grade is given a number which represents "counts." The counts are the hanks of worsted yarn that can be spun from one pound of top. A top is a strand of

TABLE 43

OLD AND NEW SYSTEM OF WOOL CLASSIFICATION

Old U. S. Grades	*New Designations*
Fine	64's, 70's, 80's
½ blood	58's, 60's
⅜ blood	56's
¼ blood	48's, 50's
Low ¼ blood	46's
Common	44's
Braid	36's, 40's



GRADES OF WOOL

The above specimens of grease wool as shorn from the sheep illustrate grades usually made in the markets for domestic wool.

The fleece is the unit in grading, although the wool of a fleece is not wholly uniform in grade. At the mill, in an operation termed "sorting", the graded fleeces are broken up into "sorts" according to fineness, length, soundness, and other properties. Fleeces and sorts are sometimes classified in numerical terms. The numerical terms of the official standards series correspond with the "blood" terms as follows:

OFFICIAL STANDARDS	"BLOOD" GRADES
80's, 70's, 64's	Fine
60's, 58's	1/2 Blood
56's	3/8 Blood
50's, 48's	1/4 Blood
46's	Low 1/4 Blood
44's, 40's, 36's	Common & Braid

FIGURE 275. *U. S. grades of wool. (Courtesy U.S.D.A. Production and Marketing Administration.)*

untwisted wool fibers straightened by combing from the combing class of wool, and each hank represents 560 yards. Thus wool of 64's quality would spin 64 x 560 yards of worsted yarn per pound of top.

Subdivisions of Market Grades. *Combing wool.* Combing wool is the highest priced wool obtained from sheep, and is 2 inches or more in length. The combing wool is used in making worsted fabrics.

Clothing wool. Clothing wool is the shortest wool, and is used in the making of less expensive wool clothing, felts, and hats.

French combing wool. This wool falls in between the combing wool and the clothing wool.

Carpet wool. Carpet wool is of low quality and coarse.

TABLE 44

GRADE, CLASS, AND WEIGHT OF FLEECE FROM COMMON BREEDS OF SHEEP

Breed	*Ave. Fleece Weight in Pounds*	*Grade of Wool*	*Length of Staple Classification*
Rambouillet	10–18	64's, 70's, 80's	Combing or Clothing
Merino (C)	10–16	64's, 70's, 80's	Combing or Clothing
Targhee	10–12	60's, 62's	Combing or Clothing
Southdown	6–7	58's, 60's	Combing or Clothing
Hampshire	7–8	56's	Combing or Clothing
Shropshire	9–10	56's	Combing or Clothing
Cheviot	6–8	48's, 50's	Combing or Clothing
Oxford	10–12	48's, 50's	Combing
Corriedale	12–15	58's, 60's	Combing
Suffolk	7–8	58's, 56's	Combing or Clothing
Dorset Horn	6–7	50's, 56's	Combing or Clothing
Columbia	10–12	48's, 50's	Combing
Leicester	10–15	36's, 40's	Combing
Cotswold	10–15	36's, 40's	Combing
Lincoln	12–16	46's	Combing

Fleece shrinkage. Wool taken directly off the sheep is known as *grease wool.* After it has been scoured it is known as *clean wool.* The removing of all dirt and oil from the fleece results in considerable shrinkage. The percentage of shrinkage depends upon the grade of wool and how well it has been prepared for market. The fleece from fine-wool breeds contains much more oil, and the shrinkage is heavier from fine wool than other grades. Wool may shrink from 45 to 80 per cent, depending upon the breed and care in handling. On the average a 50 to 60 per cent shrink may be expected.

Methods of Marketing. Two common methods are employed in marketing wool. In the first system, the crop may be sold to a private dealer or his buyer. Some dealers pick the wool up at the farm; others demand that it be brought into a shipping point. The dealer pays the market price at the time the sale is made.

The second system is marketing through a grower-owned and grower-operated cooperative. When this method of marketing is used, the producer ships the wool to his cooperative where it is graded. The producer receives a check representing from 60 to 80 per cent of the market value of his wool. All the wool is then marketed, and marketing costs are deducted. The producer receives a second check for the balance due him.

Advantages of cooperative marketing. (1) Quality wool brings a premium. (2) Small producers have as good an opportunity to sell a few fleeces as those who may ship a large consignment. (3) Wool need not be stored on the farm until a more favorable market period. (4) Any profits made by the cooperative will be distributed among the membership.

SUMMARY

Feeder lambs may be sold directly to the feeder, through a dealer, by a commission firm at a terminal market, or at an auction sale. In selecting a method of marketing one should consider the number, quality, probable shrinkage, and shipping and commission cost.

Lamb feeders are usually in the market during the fall, or early winter for lambs. Most feeder lambs are sold during this period of the year.

Most slaughter sheep are sold to the packer or packer buyer. The grade and season are important in determining the price they will bring. Slaughter sheep are graded and classified according to age, sex, weight, and quality.

The Christmas and Easter seasons usually are the periods of highest slaughter lamb prices, and the next best are the months of May and June.

The quality of wool determines the relative price it will bring. Fine, long, staple wool brings the highest prices. Wool is graded according to fineness, length of fiber, freedom from foreign material, and black fibers. A shrinkage of 50 to 60 per cent from the grease wool to clean wool may be expected. Wool may be

marketed through a dealer or through a cooperative; when marketed through a cooperative, a payment representing part of the value of the wool is paid upon delivery, and the balance is paid when the wool has been graded and sold. Profits from the cooperative are paid back to the members.

QUESTIONS

1. How may feeder lambs be sold?
2. Under what conditions are lambs sold as feeders?
3. What factors must be considered in selecting a method of marketing feeder lambs?
4. How are slaughter sheep graded and classified?
5. How does grade affect market price?
6. What is dressing per cent?
7. What are the periods when lamb prices are usually highest?
8. What factors are important in determining the time to sell fat lambs?
9. How is wool graded?
10. What are reject fleeces? Why are fleeces rejected?
11. What does 64's mean when referring to wool grades?
12. Why do fleeces shrink in cleaning? How much shrinkage may be expected?
13. What are the common methods of marketing wool?
14. What are the advantages of wool cooperatives?

REFERENCES

Alexander, M. A., Derrick, W. W., and Fouts, K. C., *Farm Sheep Facts*, University of Nebraska, Lincoln, Nebraska, Agricultural Extension Service Bulletin E. C. 255.

Marketing Feeder Cattle and Sheep in the North Central Region, University of Nebraska, Lincoln, Nebraska, Agricultural Experiment Station Bulletin 410.

Wool Preparation and Marketing, University of Wyoming, Laramie, Wyoming, Agricultural Experiment Station Bulletin 316.

Profitable Poultry Production

< 29 >

The Poultry Production Industry

Poultry and egg production was at one time a minor farm enterprise. Chickens or other fowl were kept either as a hobby, or largely to produce meat and eggs for family consumption. The young couple beginning farming always had a small flock of hens and raised some young chickens. The chickens helped to pay the grocery bill until the young farmers had income from other enterprises.

Raising poultry today is big business. Flock owners consider the enterprise an economic unit which provides a source of income and a means of livelihood. Chickens are to be found on about 85 per cent of the 6 million farms in the United States. On January 1, 1953 there were 431 million chickens on our farms.

INCOME FROM POULTRY AND EGGS

In 1949, poultry and eggs contributed 11 per cent of our national farm income. Chickens were responsible for 3.5 per cent and eggs for 6.4 per cent for a total of 9.9 per cent of our 1951 farm income. The income from poultry during that year compared very favorably with the income from other livestock enterprises. Hogs produced 12.1 per cent; dairy, 13.2 per cent; beef cattle was responsible for 21.3 per cent; and sheep contributed 1.9 per cent of our 1951 farm income.

High States in Percentage of Income from Poultry. The states having the highest percentages of farm income obtained from poultry in 1951 were Delaware, with 65.3 per cent; New Hampshire, with 49.8 per cent; New Jersey, with 40.2 per cent; Massachusetts with 38.6 per cent; and Connecticut, with 36.3 per cent. These states did not have the highest total production in terms of pounds or dollars.

Leading states in percentage of income from chickens. Accord-

FIGURE 276. *Chickens are found on 85 per cent of the farms in the United States. (Gordon photo. Courtesy* Wallaces' Farmer and Iowa Homestead.)

ing to United States Department of Agriculture estimates, the following states had the highest percentages of their farm income from the sale of chickens: Delaware, 60.6 per cent; Maryland, 19.4 per cent; New Hampshire, 18.8 per cent; Maine, 17.7 per cent; and Connecticut, with 17.3 per cent.

Leading states in percentage of income from eggs. New Jersey led all states in percentage of farm income from the sale of eggs with 32.6 per cent. New Hampshire ranked second with 31.0 per cent. Next in order were Massachusetts, 24.7 per cent; Rhode Island, 21.2 per cent; and Connecticut with 19.0 per cent.

High States in Gross Income from Chickens, Broilers, and Eggs. According to United States Department of Agriculture estimates Pennsylvania led all other states in total income from chickens, broilers, and eggs in 1950. California ranked second; Iowa, third; New York, fourth; Minnesota, fifth; Texas, sixth; Illinois, seventh; Indiana, eighth; Missouri, ninth; and Ohio, tenth.

TRENDS IN POULTRY PRODUCTION

Chickens. In 1940, nearly 95 per cent of the farms on which chickens were reported had flocks of 200 birds or less. Flocks of

1000 or more chickens were reported on less than 1 per cent of the farms. The percentage of farms on which chickens are being raised is decreasing each year, but the size of flock is increasing. A larger number of individuals are becoming specialized poultry farmers.

According to U.S.D.A. estimates, the production of chickens in the United States (excluding broilers) in 1950 amounted to 670 million birds. This was a decrease of about 10 per cent over the 1945–1949 average.

Iowa led all states in the number of chickens on farms on January 1, 1953 with 29.8 millions; Pennsylvania ranked second with 26.9 millions. The next states in order of numbers were California, 24.4 millions; Minnesota, 23.2 millions; Illinois, 20.9 millions, and Texas with 20.4 million chickens.

Broilers. Broilers and fryers are young chickens about ten to fourteen weeks of age which have been raised for meat production. Broiler production is a comparatively new industry, yet some 34 million birds were produced in 1934. The production in 1950 was 616 millions. This number almost equalled the number of chickens raised for egg production during that year. Nearly one-half of all chicks hatched now become broilers and fried chicken is popular at the dinner table at home and in restaurants. Further increases in broiler production can be expected.

The leading states in broiler production in 1950 according to U.S.D.A. estimates were Delaware, 81.2 millions; Georgia, 62.9 millions; Maryland, 54.4 millions; Arkansas, 49.2 millions; Virginia, 40.0 millions; and Texas with 33.4 millions.

FIGURE 277. *A large-scale broiler enterprise.* (*Courtesy* Broiler Growing.)

FIGURE 278. *Turkeys being raised in confinement.* (*Courtesy* Turkey World.)

Turkeys. The production of turkeys in this country has increased rapidly since 1920. During 1920 there were about 4 million turkeys on farms, by 1930 there were 17 millions, and by 1940 the number had increased to 33 millions. The number of turkeys produced in this country decreased somewhat following World War II but increased after 1948, and by 1950 approximately 45 million birds were produced.

Turkey no longer is only a Thanksgiving and holiday treat. It is served the year round, and competes with beef, pork, mutton, and chicken at the consumer markets. We can anticipate increased production and consumption of turkey.

California led all states in the production of turkeys in 1950 with 7.1 million birds produced. Texas ranked second with 4.2 millions. Other states with high production were Minnesota, 3.7 millions; Iowa, 2.8 millions; Oregon, 1.8 millions; Utah, with 1.7 millions; and Missouri, which produced 1.6 million birds.

Eggs. Up to 1937 the average hen in this nation produced about 115 to 125 eggs per year. Since 1937 the average production per hen has increased annually with an average production in 1950 of 167 eggs. More than 60 billion eggs were produced in the United

States in 1950. Egg production has been rising annually since 1935, with the largest increases occurring during the 1941–1944 period.

The highest states in egg production in 1950 were Iowa, with 4.8 billion eggs; Minnesota, with 4.3 billions; Pennsylvania, with 3.4 billions; California, with 3.2 billions; and Missouri, which produced 3.0 billion eggs. Other high production states were Ohio, Wisconsin, and New York.

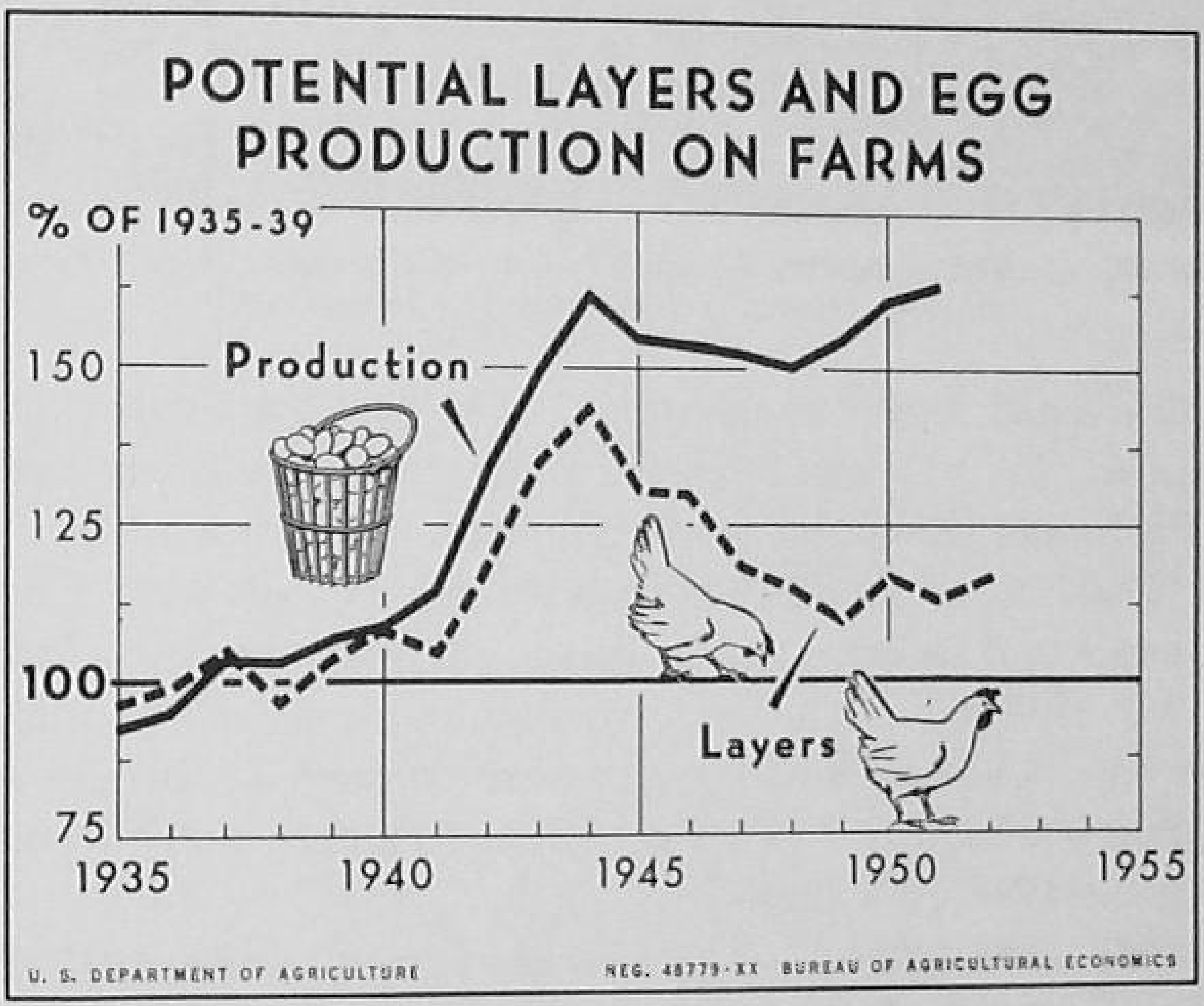


FIGURE 279.

CONSUMPTION OF POULTRY PRODUCTS

Poultry and eggs rate with milk as some of the best balanced protein foods for the human diet. These foods have always been considered essential in our diet, but we have not always been able to provide quantities of the products in the amounts needed by the peoples of this nation and of the world. Refrigeration, improvements in methods of processing, and improved methods of distribution have increased the demand for poultry products.

Per Capita Consumption. Consumption of poultry products during the 1945–1953 period has been at near peak levels. Production of these products has been high, and per capita income has also been high. Too, we have had increases in population of about 2½ million persons each year.

FIGURE 280. *Specialized poultry farm where U.S. official egg-laying tests are conducted. (Courtesy University of Connecticut.)*

Chicken and broiler consumption. The per capita consumption of chicken in 1951 was estimated to be 16.7 pounds per person, and the broiler consumption was estimated at 13.0 pounds per person. The 1951 total of 29.7 pounds was higher than the per capita consumption of chickens and broilers in any previous year. During the 1935–1939 period chicken consumption averaged 16.5 pounds, while only 1.4 pounds of broilers were consumed. Broiler consumption had increased to 8.4 pounds and chicken to 17.3 pounds during the 1947–1951 period.

Turkey consumption. The average person in the 1930–1934 period consumed about 2 pounds of turkey each year, and 5.5 pounds in 1951. Turkey production and consumption is continually on the increase.

Per capita egg consumption. Egg consumption in the United States averaged 406 eggs per person in 1951, the highest average consumption on record. The per capita consumption between 1935 and 1939 was 298 eggs. During the 1947–1951 period it averaged 389 eggs per person.

OPPORTUNITIES IN POULTRY PRODUCTION

Farmers must always be alert for methods of increasing net farm income. Poultry production on the average farm is a small, secondary industry, but changes in production and management can bring about sizable increases in farm income. An increase in flock size from 200 to 400 hens will more than double the gross income from the enterprise providing other factors remain constant. By

increasing the average egg production per hen, it is possible to further increase the income from the laying flock. The use of better methods in growing out larger numbers of broilers and roasters also presents opportunities for increasing farm income.

Specialized Poultry Farms. On some farms the poultry enterprise may be made the major enterprise. According to the 1945 *Census of the United States* specialized poultry farms comprised 4.7 per cent of the total farms of the nation, but they had on them 18.6 per cent of the nation's chickens and produced nearly one-fourth of our total egg production. Young men find specialized poultry raising stimulating and profitable, but a large percentage of our poultry farms are operated by men over fifty years of age. Specialized poultry production apparently attracts men who retire from general farming, or from other employment.

Opportunities in Poultry for Youth on the Home Farm. The poultry enterprise on the average farm provides excellent farming program opportunities for 4-H Club and Future Farmers of America chapter members. In most cases it is a small enterprise and rather poorly managed. Dad and mother may be very happy to turn the flock or enterprise over to son or daughter on a partnership basis. Some very excellent poultry enterprises have been developed in this way, and several of our best commercial poultrymen and poultrywomen got their start in this manner.

Advantages of Poultry Farming. Poultry production as a minor enterprise, and as a specialized business, has many advantages for the farmer who likes poultry and is industrious. To be successful a poultryman must be familiar with the best practices of production and marketing and must use good judgment in managing the enterprise. The following are some of the desirable features of poultry production.

Poultry and eggs are essential foods. The demand for poultry and eggs is quite permanent. Poultry is appetizing and popular as a meat. Eggs are highly digestible and nutritious. Future demand for high quality poultry and eggs appears bright.

Quick returns. Three-pound broilers can be produced in ten or eleven weeks. Pullets begin laying in four months.

Efficient production. A 3-pound broiler can be produced on 9 pounds of feed. No other meat product can be produced as efficiently on the farm. A dozen of eggs can be produced on 6 or 7 pounds of feed.

Poultry income is distributed throughout the year. Income from a laying flock and from broiler production is distributed throughout the year. All the income does not come at one or two times during the year.

Poultry production is adapted to acreages and small farms. The average size of specialized poultry farms is less than 70 acres. Chickens, turkeys, and broilers may be produced in the backyards in cities and small towns, on acreages, or on farms.

Quick turnover of capital. Capital invested in broiler production is returned in less than three months, and capital invested in a laying flock starts coming back in about four months. Income from turkeys is somewhat slower, depending upon the weight of turkeys produced.

Poultry markets are standardized and well established. Eggs and poultry are sold according to grade, and many avenues are available for marketing of poultry products.

Poultry production may be a full-time or part-time occupation. On most farms and acreages, poultry production is a part-time activity. On specialized farms it may require all the time of one or more persons. A sizeable income may be realized from poultry production, even though the individual producer has other employment.

Poultry production is a science which involves knowledge and proven practices. Much experimentation has taken place in poultry breeding, feeding, management, and marketing. An individual has information available to plan profitable production and management programs.

Women, children, and elderly men can be successful in poultry production. Few farm enterprises can compete with poultry as sources of income for women, children, and elderly men. The work is not strenuous and does not require high skill. Women and children may be very successful in poultry production.

Problems in Poultry Production. The production of broilers, chickens, turkeys, and eggs involves many problems. Certain limiting factors are apparent.

Disease and parasite problems. While chickens and turkeys are normally healthy, they are subject to many diseases and parasites. These losses may be heavy if proper methods of prevention and treatment have not been followed.

Problems in feeding and management. Feed costs may become

excessive and the enterprise unprofitable, if the birds are not fed balanced rations in proper amounts. Housing, ventilation, and labor problems may also affect the profit from the enterprise.

Selection of chicks, poults, and mature birds. It takes good seed stock to have profitable production. Chicks and poults must be selected according to the use to be made of them, and they must be bought right. The laying flock must be carefully culled, and birds used in breeding pens must be carefully selected.

Problems in marketing. The profit from the poultry enterprise is influenced by the market. Eggs, broilers, roasters, and turkeys bring more money during some seasons than others.

Size of enterprise. The fact that a chick, hen, or turkey is short lived and requires only a small investment may cause the producer to become careless. The larger the unit, the easier it is to give the enterprise the care and management which it should receive.

SUMMARY

Nearly 10 per cent of our national farm income is derived from the sale of poultry products. This percentage almost equalled the percentage of income from dairy, or from hog production. In some New England states poultry brings in as much as 40 to 60 per cent of their farm income. Pennsylvania, California, Iowa, and New York led all states in total income from chickens, eggs, and broilers in 1950.

In 1950 nearly 616 million broilers and 670 million chickens were produced in this country. Iowa and Pennsylvania led all states in the number of chickens on farms on January 1, 1953. Broiler production has increased rapidly during the past few years, especially in Delaware, Georgia, Maryland, and Arkansas.

Turkey production has increased from a production of 4 millions in 1920 to 45 millions in 1950. California, Texas, Minnesota, and Iowa were the high production states in 1950.

Egg production per hen has increased from about 120 eggs per hen in 1937 to 167 eggs per hen in 1950. More than 60 billion eggs were produced in 1950. Iowa, Minnesota, Pennsylvania, and California led the states in egg production in 1950.

Eggs rate with milk, and poultry with beef steak and pork chops, as human foods. Nearly 29.7 pounds of chicken and broilers, 5.5 pounds of turkey, and 406 eggs were consumed by each person in the United States in 1951. More poultry products were consumed per person in 1951 than in any previous year.

Poultry production is big business. Chickens are raised on about 85 per cent of our farms. In most cases the enterprise is a minor enterprise; however, the number of farms on which it is a major enterprise is increasing. Poultry production offers excellent opportunities for youth, women, and elderly men.

Poultry production has many advantages. Chickens and eggs are staple foods. Chickens are efficient converters of feeds into meat. The returns from the enterprise are rapid, and the capital turnover is also rapid. The income is distributed throughout the year, and the enterprise is adapted to large or small farms. Poultry production may be a full- or part-time occupation.

Raising chickens and turkeys involves management problems related to selection of stock, feeding, housing, disease control, brooding, management, and marketing. Knowledge is available, however, regarding proven practices. Poultry production can be a very profitable enterprise.

QUESTIONS

1. What percentage of your home farm income is derived from the sale of: (*a*) chickens? (*b*) broilers? (*c*) turkeys? (*d*) eggs?
2. What states lead in the production of: (*a*) chickens? (*b*) broilers? (*c*) turkeys? (*d*) eggs?
3. How much feed does it take to produce a pound of broiler?
4. How much feed does it take to produce a dozen eggs?
5. What changes have come about in the production of poultry products during the past twenty years?
6. Is poultry production increasing or decreasing in your home community? Why?
7. What are the advantages of poultry production over swine, sheep, dairy, and beef production?
8. What problems have you encountered in producing poultry products on your farm?
9. What should be the place of poultry production on your farm? Explain.

REFERENCES

Botsford, Harold E., *The Economics of Poultry Management*, John Wiley and Sons, Inc., New York, 1952.

Card, Leslie E., *Poultry Production*, Lea and Febiger, Philadelphia, 1952.

Charles, T. Burr, and Stuart, Homer O., *Commercial Poultry Farming*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Darrah, L. B., *Business Aspects of Commercial Poultry Farming*, The Ronald Press Company, New York, 1952.

Jull, Morley A., *Successful Poultry Management*, McGraw-Hill Company, Inc., New York, 1951.

Weeks, John P., *The Poultry Profit Guide*, Vulcan Press, Birmingham, Alabama, 1952.

< 30 >

Selecting Chicks and Birds for Production

The successful poultryman is very careful in buying chicks, and in selecting birds for his breeding or laying flock. The poultry enterprise is something like a twenty-story building in the city. The building is no better than its foundation. If it is built on a poor foundation, the building is weak, requires considerable upkeep, and is a poor investment. The chicks or pullets that you buy are the foundation for your poultry enterprise. Good feeding, housing, management, and marketing practices can overcome in part poor foundation stock, but for maximum profits you must begin with good stock.

SELECTING A BREED

We have breeds of cattle which are kept primarily for milk production, and breeds which are kept for the production of meat. Certain breeds of sheep are kept for wool production. Others produce wool, but are kept primarily for the production of mutton. We have much the same situation in chickens—we have numerous breeds and varieties. Some of them are kept primarily for egg production, while others have as their major function the production of meat. Some breeds are dual purpose. They are rather good in the production of both meat and eggs.

When we buy a tractor, we select one which is best adapted to the needs of our farm, one which is efficient in operation, and one which is available at a reasonable price. We select chicks or foundation poultry in the same manner. There is no best make or size of tractor, and there is no one best breed or variety of chicken. We select a breed to suit our individual farm, community, and market needs.

Classes of Chickens. There are many classes of chickens, but most of the chickens produced in this country are in one of the

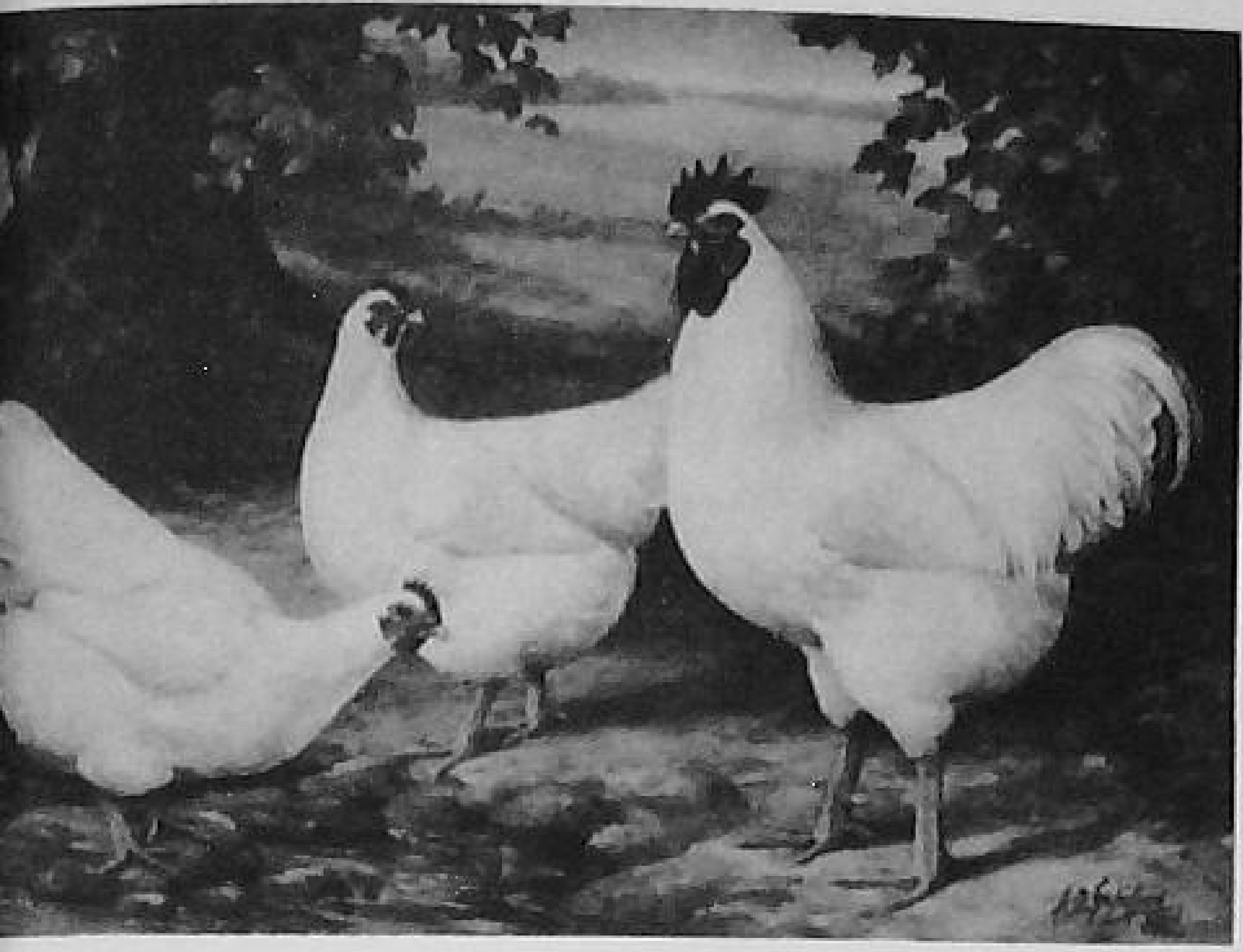
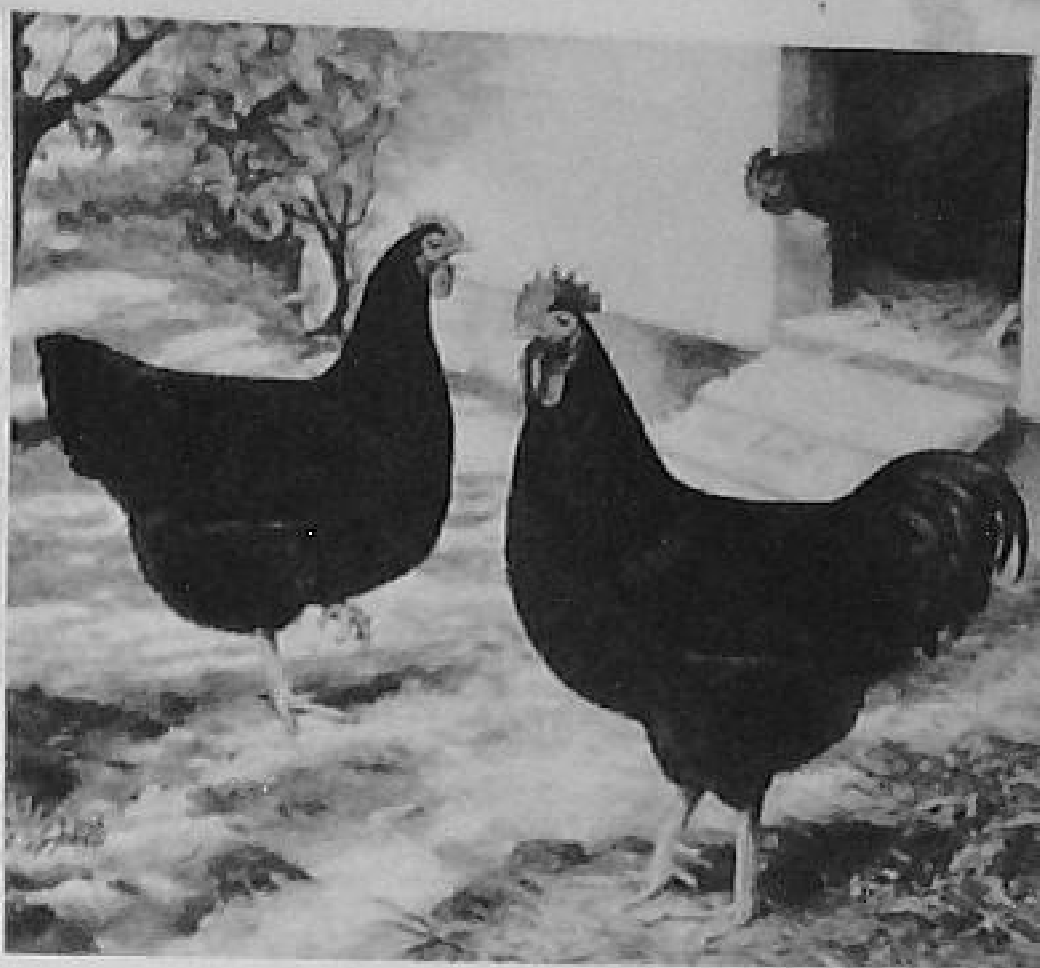



FIGURE 281. *(left) White Plymouth Rock chickens.* (*Courtesy* Poultry Tribune.)
FIGURE 282. *(right) Rhode Island Red chickens.* (*Courtesy* Poultry Tribune.)

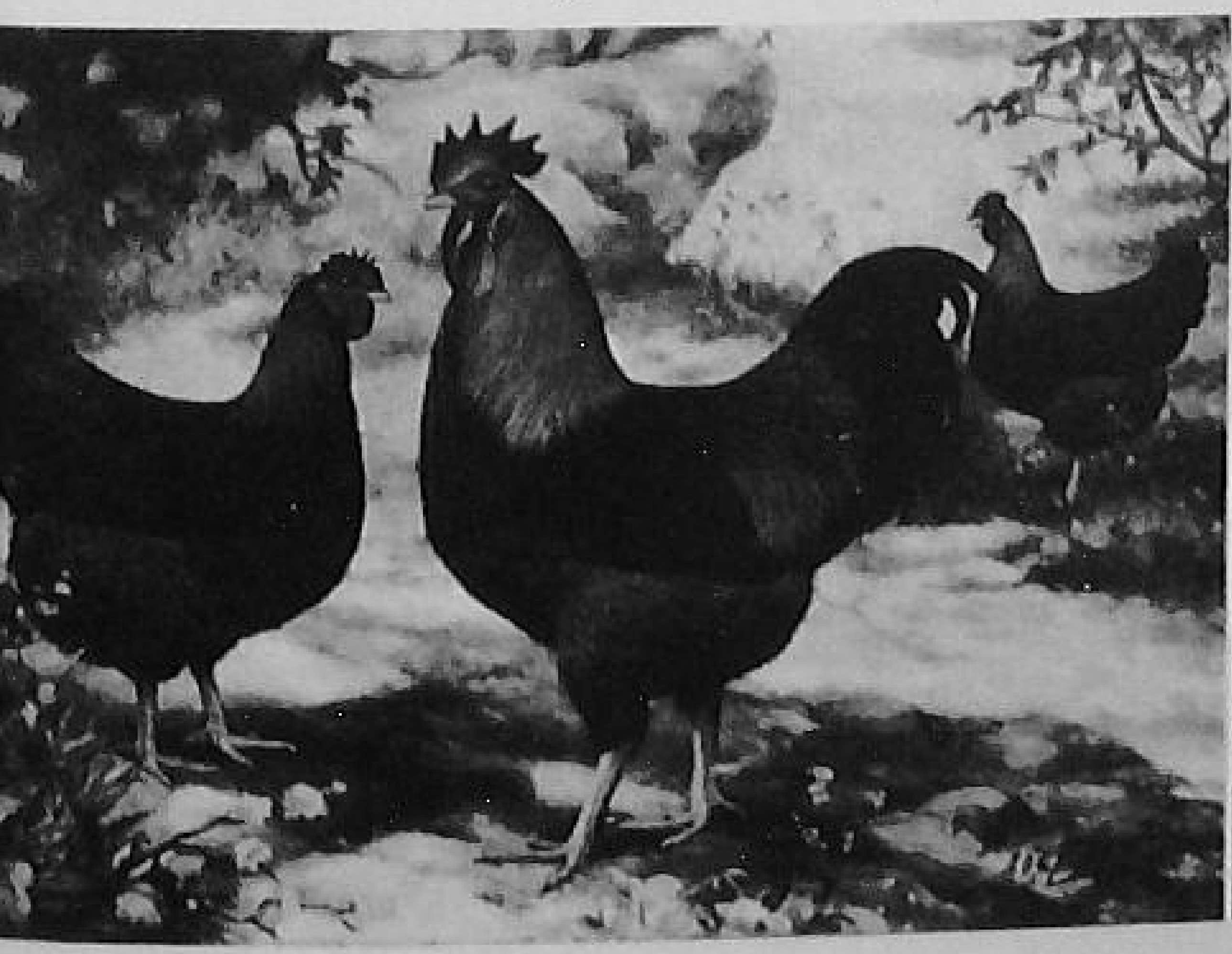
following four classes: (1) American, (2) Mediterranean, (3) English, and (4) Asiatic.

American class. The Plymouth Rock, Wyandotte, Rhode Island Red, New Hampshire, and Jersey Black Giant are the most popular of the American class. Other breeds in this class are the Rhode Island White, the Java, the Dominique, and the Holland.

No birds in this class have feathered shanks. They all have yellow shanks and skin and red ear lobes. The breeds of the American class have been bred for both meat and egg production.

Mediterranean class. The Leghorn, Minorca, and Ancona breeds are the most popular Mediterranean breeds in this country.

FIGURE 283. *(left) New Hampshire Red chickens.* (*Courtesy* Poultry Tribune.)
FIGURE 284. *(right) White Wyandotte chickens.* (*Courtesy* Poultry Tribune.)



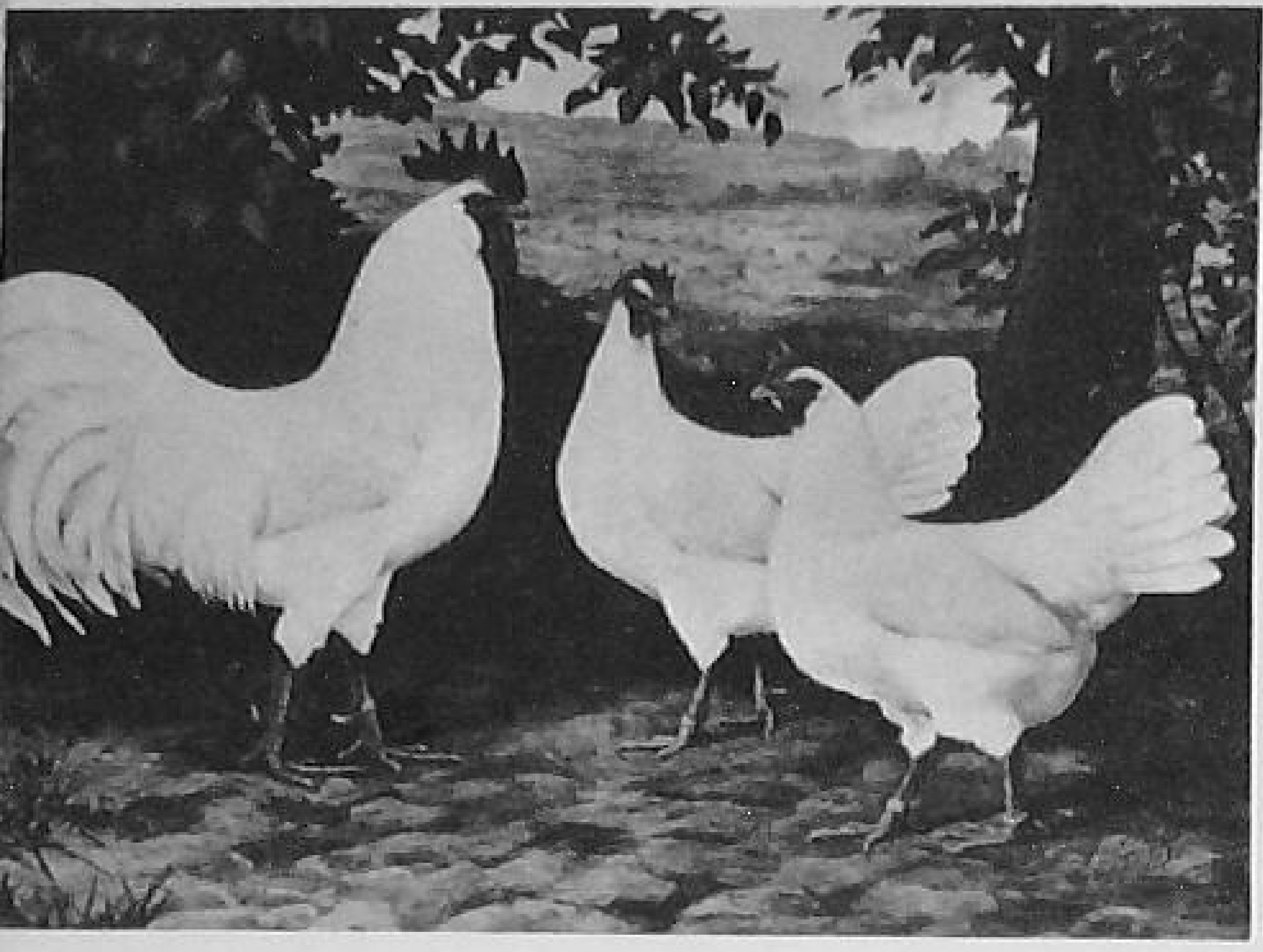
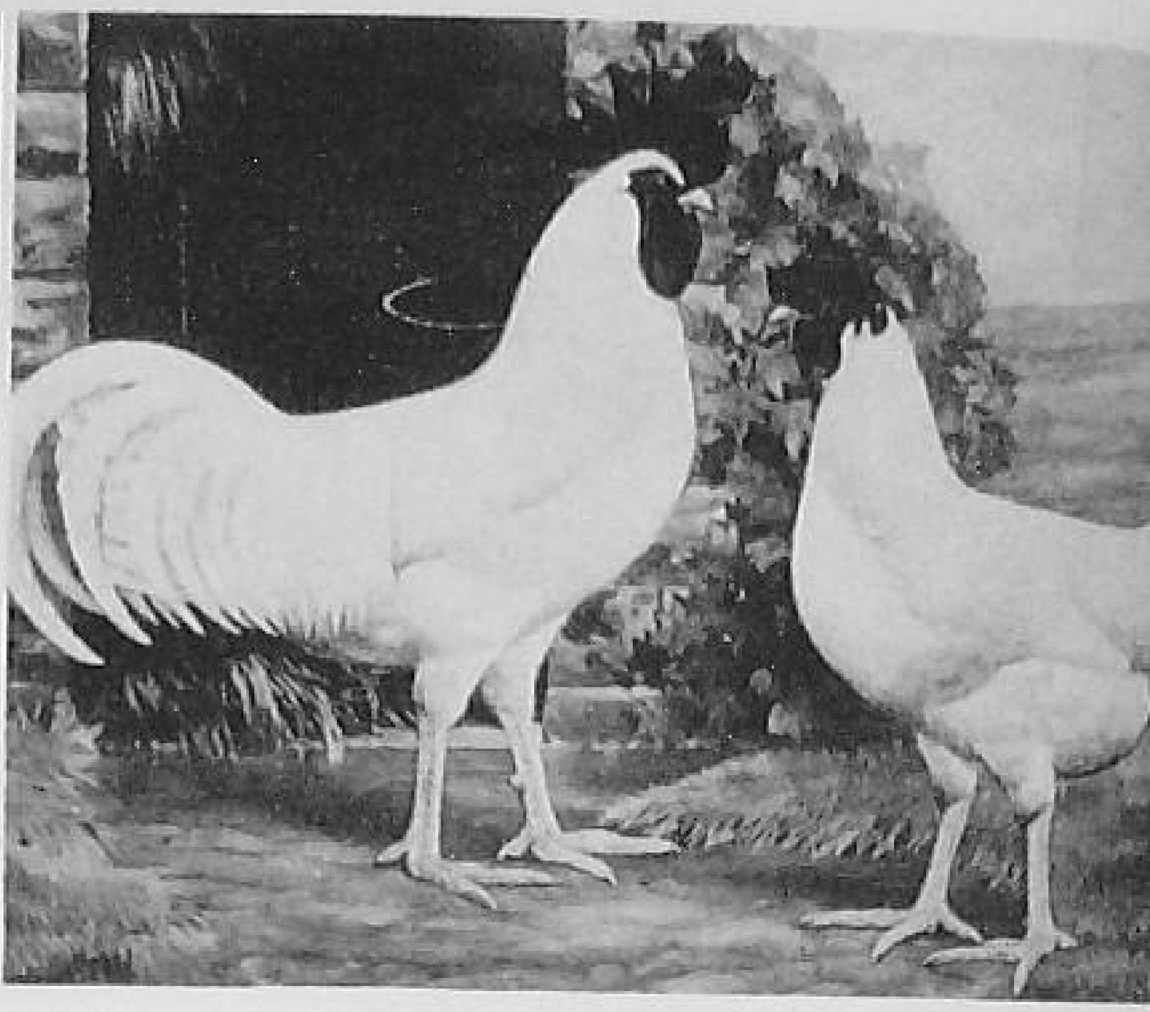
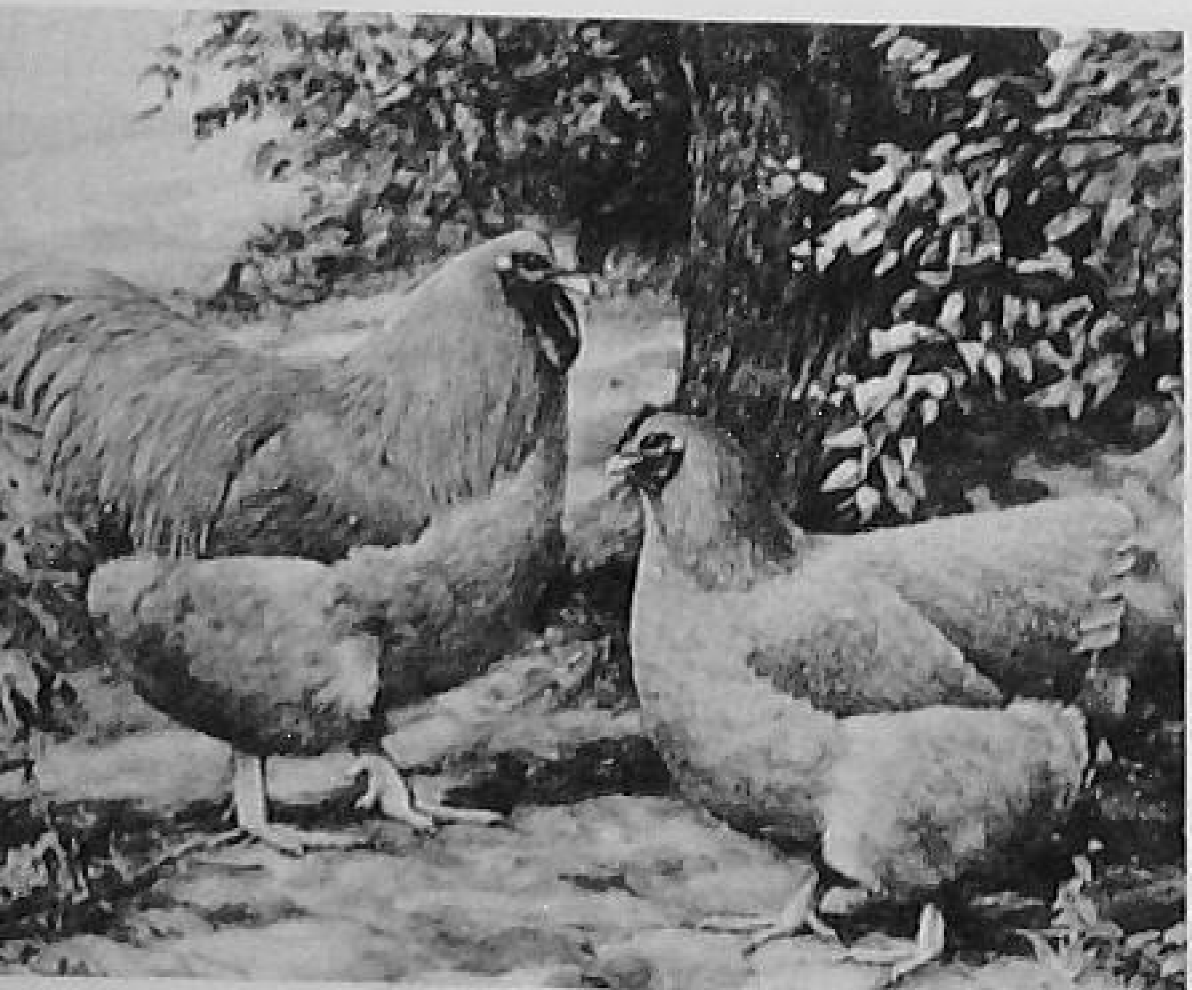
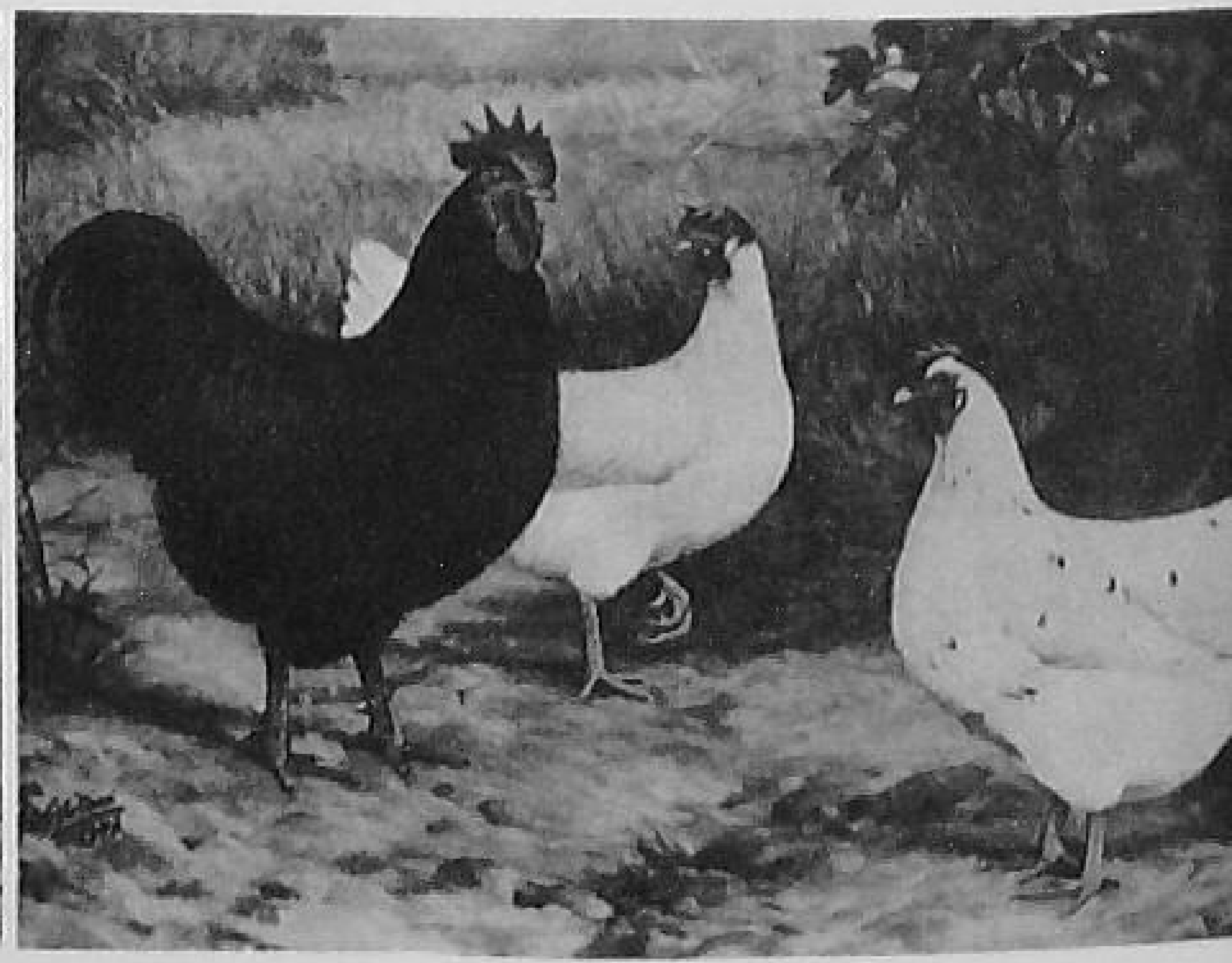



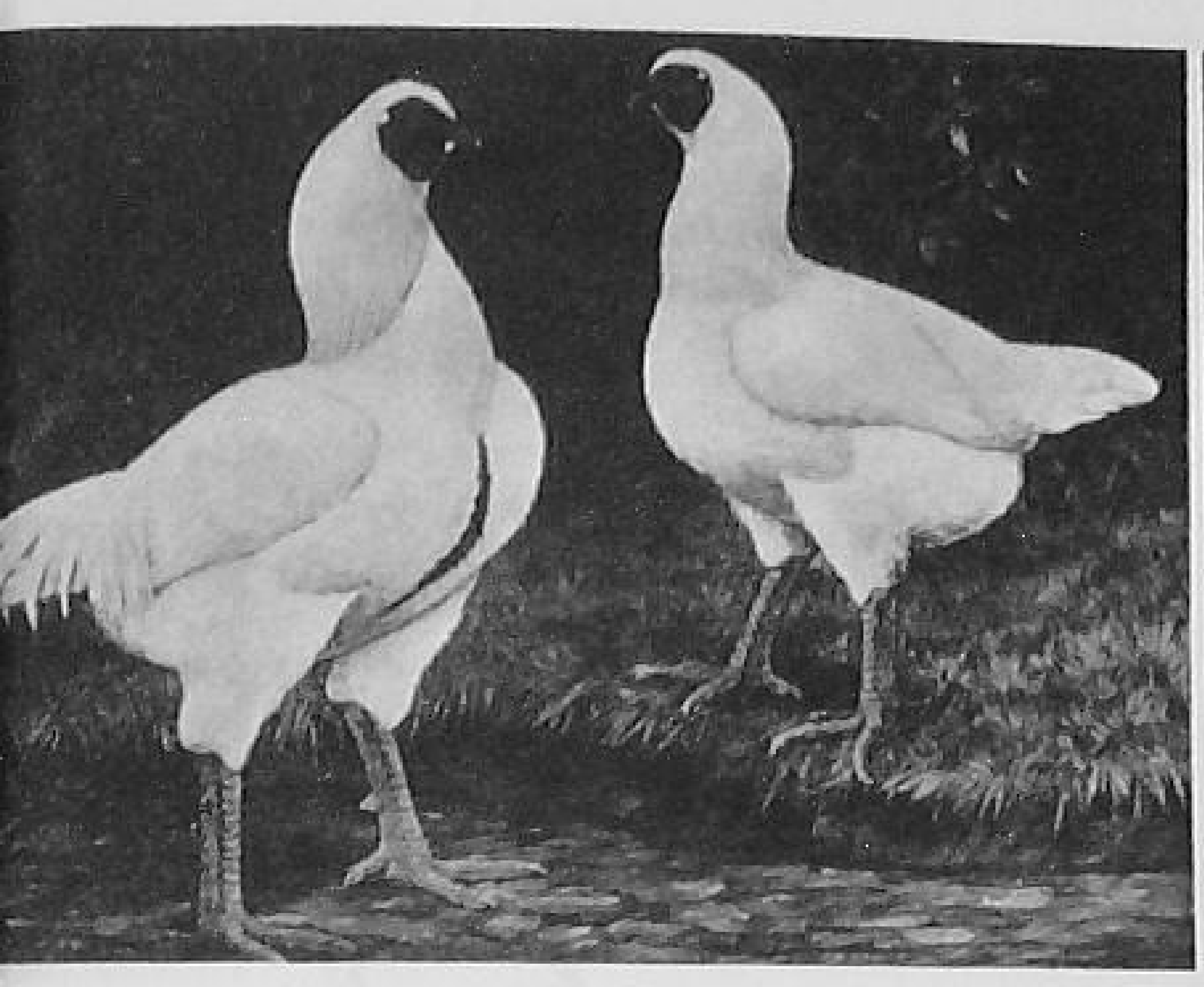
FIGURE 285. *(left) White Leghorn chickens. (Courtesy* Poultry Tribune.)
FIGURE 286. *(right) White Minorca chickens. (Courtesy* Poultry Tribune.)

The other breeds of this class grown in this country are the Blue Andalusian, Buttercup, and Spanish. The Mediterranean breeds are kept primarily for egg production. They are smaller than the American, English, and Asiatic breeds, and have white ear lobes. They all lay white eggs.

English class. The most popular breeds of this class are the Orpington, Australorp, and the Cornish. Three other breeds are grown—the Dorking, Sussex, and Red Cap. The English breeds have good meat quality. They are large, and with the exception of the Cornish, have white skin.

FIGURE 287. *(left) Buff Orpington chickens. (Courtesy* Poultry Tribune.)
FIGURE 288. *(right) Australorp and White Leghorns when crossed produce Austra-Whites. (Courtesy* Poultry Tribune.)



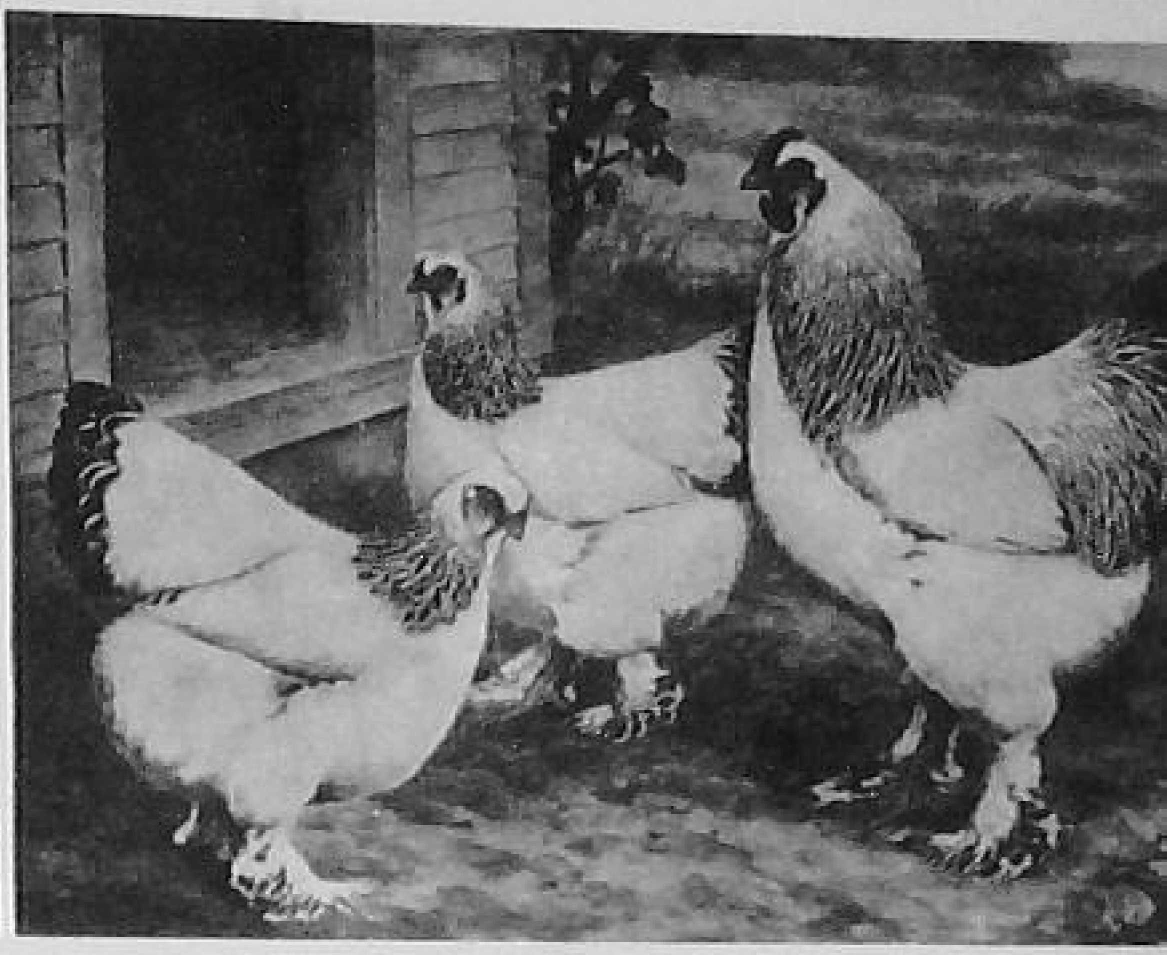
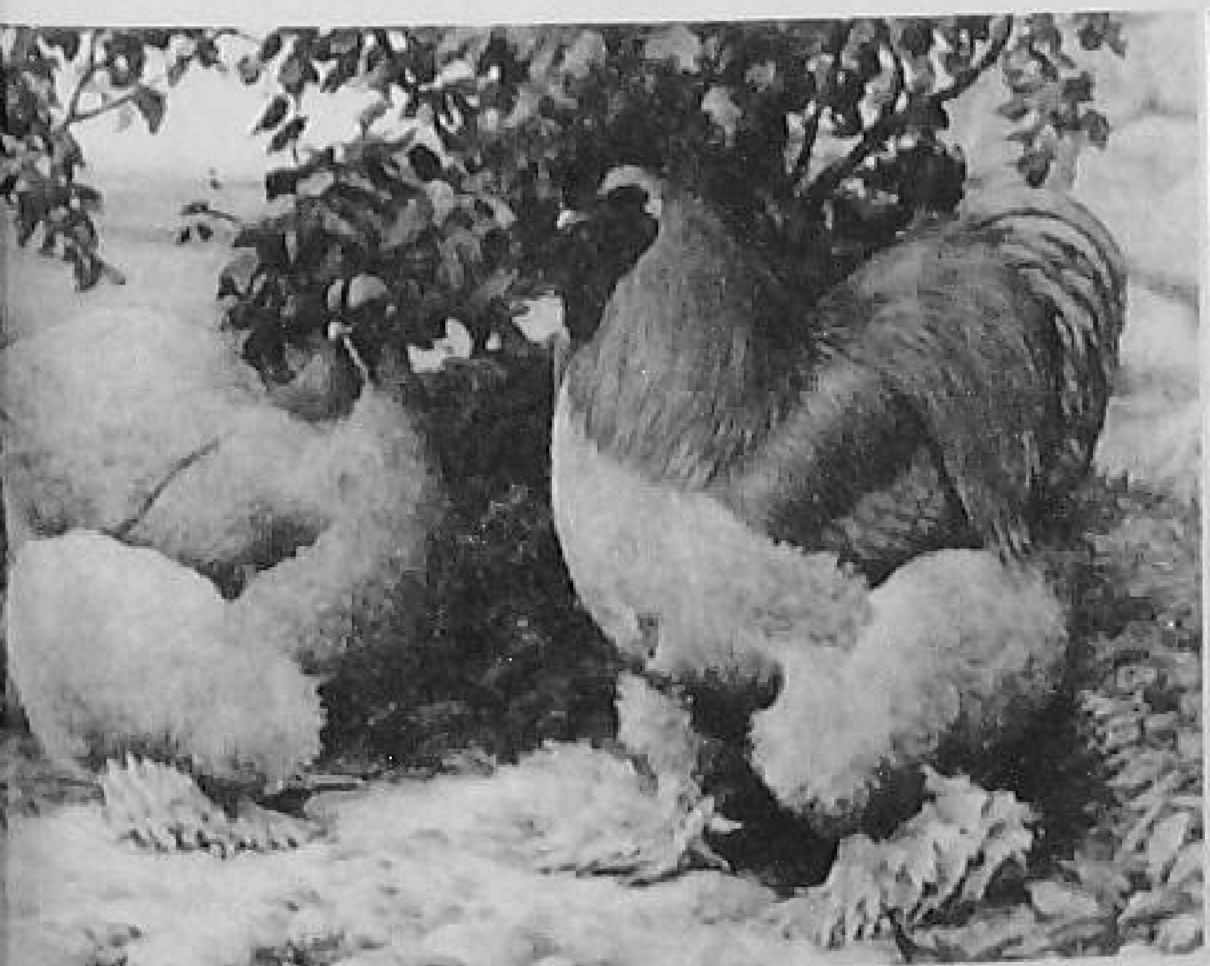


FIGURE 289. *(left) White Cornish chickens. (Courtesy* Poultry Tribune.)
FIGURE 290. *(right) Light Brahma chickens. (Courtesy* Poultry Tribune.)

Asiatic class. The three breeds of this class—the Brahma, Cochin, and Langshan—are not grown in large numbers in this country, but have been used in producing the American breeds. All three breeds have feathered shanks, are large and heavy boned, and have red ear lobes. With the exception of the Black Langshan, they have yellow skin. The Asiatic breeds are produced largely for meat production.

Breeds and Varieties of Chickens. The characteristics of the most common breeds of chickens are shown in Table 45. Some breeds are subdivided into varieties according to color of feathers and type of comb. There are seven varieties of Plymouth Rocks: the

FIGURE 291. *(left) Buff Cochin chickens. (Courtesy* Poultry Tribune.)
FIGURE 292. *(right) White Langshan chickens. (Courtesy* Poultry Tribune.)



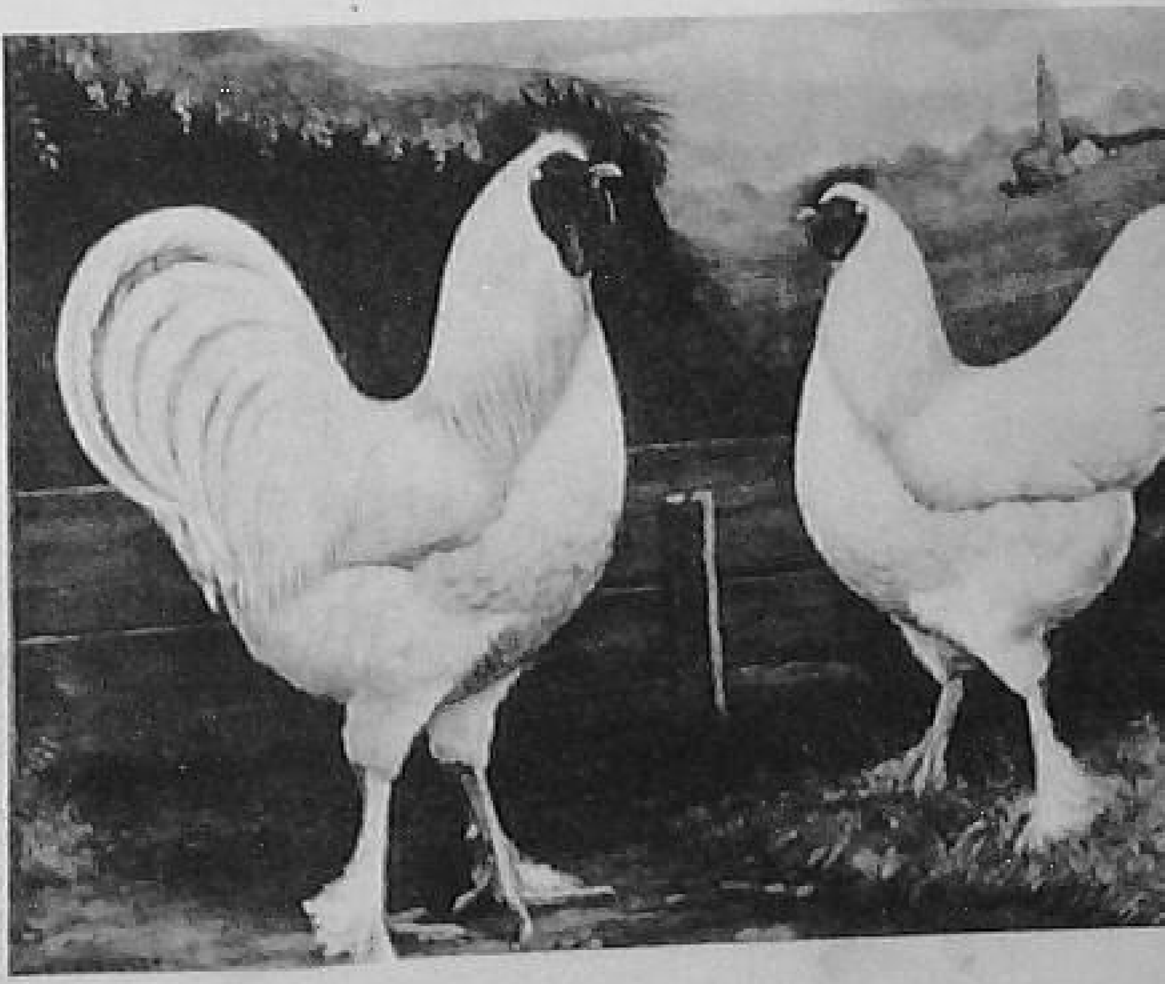


TABLE 45

CHARACTERISTICS OF COMMON BREEDS OF CHICKENS

Breed	*Weight (lbs.)*	*Color of Skin*	*Color of Shank*	*Feathered Shanks*	*Type of Comb*	*Color of Earlobe*	*Color of Egg*
AMERICAN BREEDS:							
Jersey Black Giant	10–13	Yellow	Black	No	Single	Red	Brown
New Hampshire	6½–8½	Yellow	Yellow	No	Single	Red	Brown
Plymouth Rock	7½–9½	Yellow	Yellow	No	Single	Red	Brown
Rhode Island Red	6½–8½	Yellow	Yellow	No	Single and rose	Red	Brown
Wyandotte	6½–8½	Yellow	Yellow	No	Rose	Red	Brown
MEDITERRANEAN BREEDS:							
Ancona	4½–6	Yellow	Yellow	No	Single and rose	White	White
Leghorn	4½–6	Yellow	Yellow	No	Single and rose	White	White
Minorca (white)	7–9	White	White	No	Single	White	White
ENGLISH BREEDS:							
Australorp	6½–8½	White	Dark slate	No	Single	Red	Brown
Cornish (dark)	8–10	Yellow	Yellow	No	Pea	Red	Brown
Orpington (Buff and white)	8–10	White	White	No	Single	Red	Brown
ASIATIC BREEDS:							
Brahma (light)	9–11	Yellow	Yellow	Yes	Pea	Red	Brown
Cochin	8½–11	Yellow	Yellow	Yes	Single	Red	Brown
Langshan (black)	7–10	White	Bluish-Black	Yes	Single	Red	Brown

barred, white, buff, silver penciled, partridge, Columbian, and blue. Wyandottes have eight varieties classified according to color of feather. There are four varieties of Orpingtons: the buff, black, white, and blue. The Leghorn and Minorca breeds are subdivided into varieties according to both color and type of comb. White and buff are the most popular colors.

Nearly 200 varieties of chickens are listed in the *American Standard of Perfection*, but only five were of commercial importance in 1943. The White Leghorn, the New Hampshire, the White Plymouth Rock, the Barred Plymouth Rock, and the Rhode Island Red accounted for about three-fourths of all chickens raised.

Hybrid and crossbred chickens. Considerable work has been done recently in the production of crossbred or hybrid chickens. Agricultural experiment stations and commercial poultry breeders have developed inbred lines and have made line crosses similar to those made in the production of hybrid corn. The use of hybrid and crossbred chickens has been on the increase both in the production of eggs and in broiler production.

Most farmers rely upon the commercial hatcheryman to maintain the breeding flocks and make the crosses necessary to produce hybrid or crossbred chicks. The lines and crosses available vary with the community and with the section of the country.

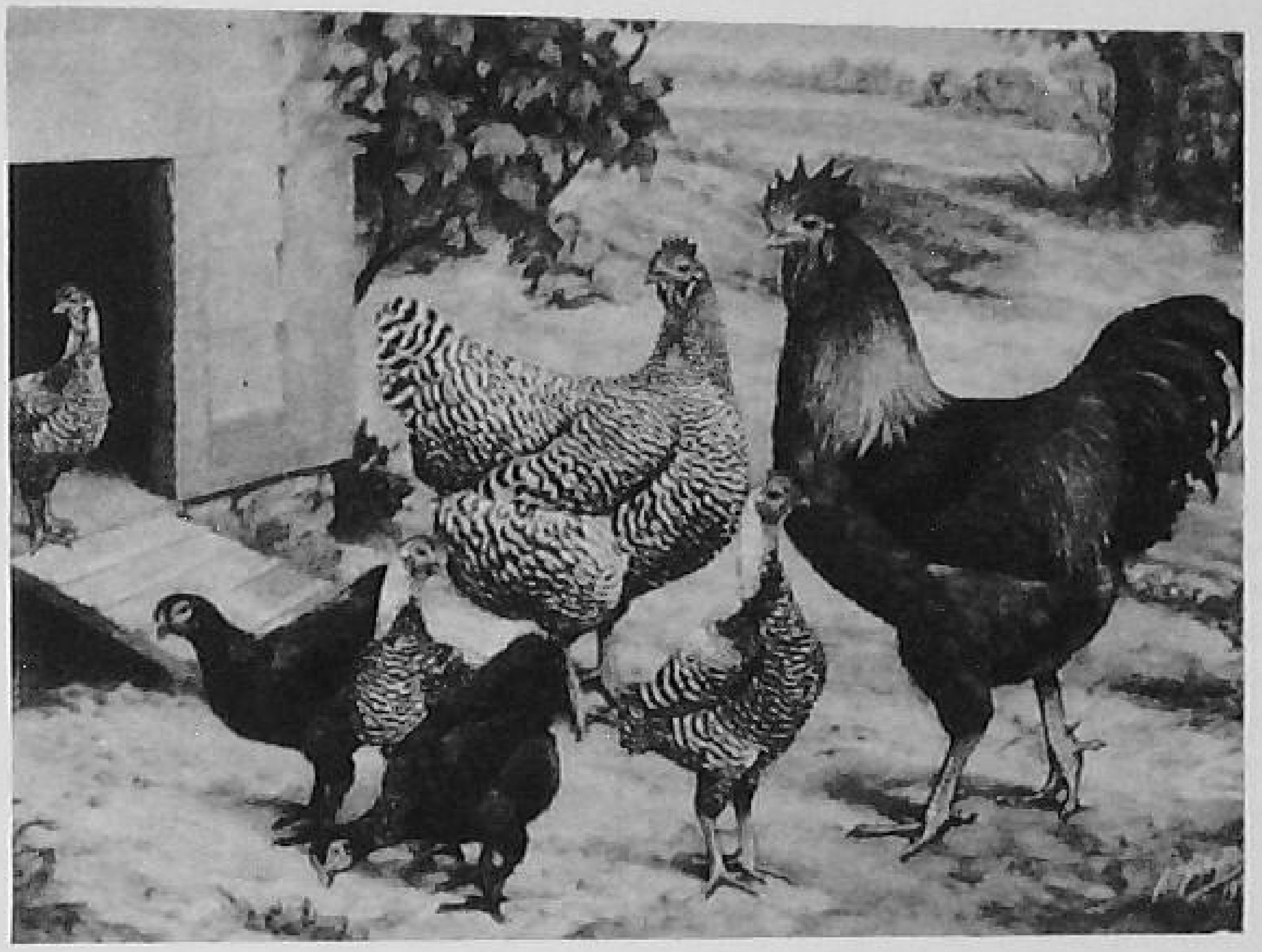


FIGURE 293. *Crossbred chickens. The male chicks have the color of Barred Plymouth Rock hen and the female chicks have the color of the New Hampshire Red rooster. (Courtesy* Poultry Tribune.)

Up to the close of World War II, a cross between the Barred Rock and New Hampshire was very popular. This cross has become unpopular because of the dark feathers. White Rocks crossed with the New Hampshires and with Wyandottes are popular crosses. The crossing of Cornish chickens with White Rocks, with White Wyandottes, and with New Hampshires produces excellent broilers.

It has been found that increased egg production may be obtained by crossing inbred lines of high producing strains of our standard breeds of chickens. Many of the commercial laying flocks in some areas are composed of crossbred or hybrid chickens. Crosses between the Black Minorca and White Leghorn breeds are popular as are crosses between New Hampshires and White Leghorns.

Some of the chicks which are sold as hybrids are merely crossbred chicks. The crossing of two or more unrelated noninbred breeds of chickens produces crossbred chicks. Hybrid chicks are produced when inbred lines of two or more breeds are crossed.

Popularity of the breeds. Some breeds and varieties of chickens are more popular in certain areas than in others. An indication of the popularity of the breeds is shown in the summaries of entries in the official egg laying contests conducted in this nation, and in the list of breeds represented in the National Poultry Improvement plan.

TABLE 46

SUMMARY OF 1951–1952 U.S. OFFICIAL EGG LAYING TESTS *
(Breeds represented with 200 or more entries)

Breed	*Birds Entered*	*Eggs Laid Per Bird*	*Per Cent Mortality*	*Av. Egg Size (Oz. per Doz.)*
S. C. White Leghorn	4,329	221.9	14.8	24.78
Rhode Island Red	1,586	226.3	12.3	24.96
New Hampshire	1,235	207.5	9.8	24.96
Crossbreds	884	212.3	19.8	24.88
White Plymouth Rock	871	190.1	17.8	24.76
Incrossbred	754	227.0	18.0	24.72
Barred Plymouth Rocks	663	223.6	14.0	24.88

* Report No. 14, Council of American Official Poultry Tests, Storrs, Conn.

TABLE 47

BREEDS OF CHICKENS IN NATIONAL POULTRY IMPROVEMENT PLAN HATCHERY FLOCKS 1949–1950

Breed	*Region*						
	North Atlantic (%)	*East North Atlantic* (%)	*West North Central* (%)	*South Atlantic* (%)	*South Central* (%)	*Western* (%)	*475 Sta.* (%)
New Hampshire	49	26	21	68	44	39	39
White Leghorn	15	24	32	6	15	42	22
Cross Mated	7	12	25	18	15	9	15
White Plymouth Rock	3	23	13	1	11	2	10
Barred Plymouth Rock	15	8	2	2	7	1	6
Rhode Island Red	10	2	2	2	3	5	4
Other Breeds	1	5	5	3	5	2	4

BUYING BABY CHICKS

Most poultrymen buy their chicks. According to U.S.D.A. data, less than 8 per cent of the chicks produced in this nation in 1949 were hatched on farms. The number hatched on farms in the Corn Belt is very small. Farmers rely upon the commercial hatcheries for their chicks for they are able to maintain better breeding flocks and can produce healthier chicks at a lower cost than can be done on farms.

The hatchery business has become a large industry. More than

9000 hatcheries are in operation in the nation, and nearly one-fourth of them are located in the North Central Region or the Corn Belt states. Iowa, Missouri, Illinois, Ohio, and Minnesota lead the states in chick production.

Chicks are raised each year on most farms to replace the laying flock, and for broiler and roaster production. While the use to be made of chickens may vary, much the same factors are involved in selecting and buying chicks. They may be enumerated as follows: (1) source, (2) time to order, (3) breeding and quality, (4) sex, (5) age, and (6) price.

Source. *Buying near home.* It is best to buy chicks from hatcheries close to home where you can pick them up, if other factors are equal. Chicks can be transported long distances, but losses are usually lighter when you buy close to home, and you are better able to determine the reputation of the hatchery.

Reputation and reliability of hatchery. The reputation of a hatchery spreads rapidly from one person to another. Before ordering chicks, a check should be made with other poultrymen, concerning the reliability of the various hatcheries. Hatcheries which are operating under the supervision of the National Poultry Improvement Plan, through the state agency, are good sources.

Shipping chicks. Chicks should be placed in the brooder and fed within twenty-four to forty-eight hours after the hatching time. Government regulations limit the time chicks can be in transit to seventy-two hours. Choose a hatchery which can transport the chicks to you in as short a time as possible. Chicks should be shipped in ventilated boxes with no more than twenty-five chicks in a section.

Time to Order. The time to order chicks will vary with the hatchery, but it is usually best to place your order several weeks or months before you wish delivery. The best hatcheries have orders booked several weeks in advance.

Early hatched chicks make the most money. Broilers and roasters hatched in February and March will reach the market before prices drop in the early summer. Early hatched pullets can be brought into production before egg prices reach their peak in the fall. February and March chicks are best as laying flock replacements. Allow a few more weeks for heavy breeds to mature than the lighter breeds.

Breeding and Quality. The most important factor in buying chicks is to get healthy chicks of desirable breeding.

Cheap chicks are usually expensive. You get about what you pay for in buying chicks. The few cents difference between the price of a good chick and an inferior one may result in as much as a dollar or more increase in egg production per bird, or the difference between profit and loss in raising broilers.

Buy chicks from pullorum free flocks. Check with the hatcheryman concerning the health of the flocks. Pullorum may be communicated from the hen to the chick through the egg. Flocks supervised by the state agency of the National Poultry Improvement Plan are preferred.

Check the production records of the parent stock. Certain strains of the various breeds of chickens have been proven as egg producers, and as good broiler producers. Find out everything possible about the birds used in the hatchery flocks. Visit the flocks if possible. Check egg laying test records. Buy chicks that are bred to produce.

FIGURE 294. *Marking eggs from trap nests. (U.S.D.A. Photograph by Knell. Courtesy* Hatchery Tribune.)

Sex. The use to be made of the chicks and the price determine the sex to buy.

Straight-run chicks. Chicks, as they come from the incubator, are straight-run chicks. The number of males is about equal to the number of females. Some farmers like to buy straight-run chicks. They feed out the cockerels as broilers and keep the pullets for the home flock. Sometimes the cost of the straight-run chicks is less than the cost of the same number of sexed cockerel and sexed female chicks. In raising straight-run chicks, about three chicks should be purchased for every pullet that is to be placed in the laying house.

Sexed chicks. It is sometimes advantageous to buy sexed chicks. Leghorn cockerels are not usually profitable as broilers. Poultrymen desiring pullet replacements often prefer to pay nearly twice as much per chick for sexed pullets than they would have to pay for straight-run chicks. The price spread between straight-run and sexed heavy breeds is not as wide as with Leghorns.

Methods of sexing. Efficient chick sexers can determine the sex of chicks without injuring them. Three methods are in use: (1) Some crosses may be sexed by the color of down on the newly hatched chicks; (2) the sex of others may be determined by the length of primary wing feathers, or by the number of secondary wing feathers; and (3) an examination of the rudimentary sex organs of the chick is conducted.

Age. Some purchasers like to buy started chicks which are from two to four weeks old. Chick losses usually occur during the first week or two, but by buying started chicks these losses may be avoided. The price of started chicks is usually high. Before purchasing started chicks, the cost of brooding and feeding chicks for two weeks should be figured and losses should be estimated. There are times when it is more practical, convenient, and profitable to buy started chicks.

Price. When all other factors are equal, price may be the determining factor in buying chicks. Usually, however, other factors are not equal. Price in buying chicks should be considered, but money invested in high quality chicks brings in a better income than capital invested in poor quality chicks.

CULLING THE FLOCK

Feed cost in poultry production is an important item. Accord-

FIGURE 295. *Crossbred pullets in the laying house.* (*Courtesy* Poultry Tribune

ing to the Nebraska Circular 1465, the feed cost per hen for th flocks in the Nebraska Cost Account project in 1952 was $5.9 The average hen produced 184 eggs. When feed costs are hig the importance of culling is magnified. Every nonproductive an inefficient bird in a flock lowers the profit from the enterprise Each hen in the average flock must lay 150 or more eggs to come out even. During some seasons the production must be higher t keep out of the red. One of the best means of increasing egg pro duction per hen is to cull out the nonlaying boarders.

Chicks and broilers need culling as well. There is no need to waste feed by feeding inferior birds.

Culling Chicks. Crippled, weak, and runty chicks should be disposed of when chicks are placed in the brooder house. It does not pay to keep cull chicks. They seldom make a profit, and they may become carriers of disease.

Culling Pullets. Pullets should be culled carefully as they are placed in the laying house in the fall. Only well-grown, healthy, mature birds should be kept. Birds which are undersized, deformed, or diseased should be culled out. Keep only pullets which have attractive heads, bright eyes, good beaks, and bright feathers.

Culling the Laying Flock. Most poultrymen try to maintain flocks with 60 to 70 per cent egg production. They want sixty or seventy eggs from each 100 hens each day. To do this, they must watch the flock closely and remove the nonlayers. Culling is not a practice to be done once a year when the pullets are placed in the laying house; it is a continuous process. Some cullings should be done each week or month. The longer you leave the nonlayer in the flock, the greater the loss in feed.

Some poultrymen do their culling at night with the aid of a

flashlight. The culled birds are placed in a coop where they can be examined more carefully the following morning.

How to Select Good Layers. It is not difficult to select the layers from the nonlayers. Anyone familiar with chickens can become quite skilled in culling practices in a rather short time. Selection and culling are usually based upon the following: (1) condition of comb and wattles, (2) brightness of the eye, (3) body capacity, (4) handling quality, (5) condition of the vent, (6) amount of pigment, and (7) the stage of molt.

Condition of comb and wattles. The comb of a layer is large, red, and glossy. It is warm due to blood circulation. The comb of a nonlayer is small, pale, dry, stiff, scaly. The head of a nonlayer may be puffed or swollen. The wattles of layers are large, bright red, and warm. The wattles shrink and become pale when the hen goes out of production.

Brightness of eye. A good layer has a large, prominent, and bright eye. Poor layers have small, sunken, or dull eyes. The eye is a good indication of health. Birds with gray eyes or irregular shaped pupils should be culled. They may be infected with leucosis.

Body capacity. To be a good layer, a bird must have a big body. Layers consume large quantities of feed and need space in the body cavity for the production of eggs. The abdomen of a layer is expanded. There should be room for two to four fingers

FIGURE 296. *(left) The head of a good layer. (right) An undesirable head. (Courtesy* Poultry Tribune.*)*

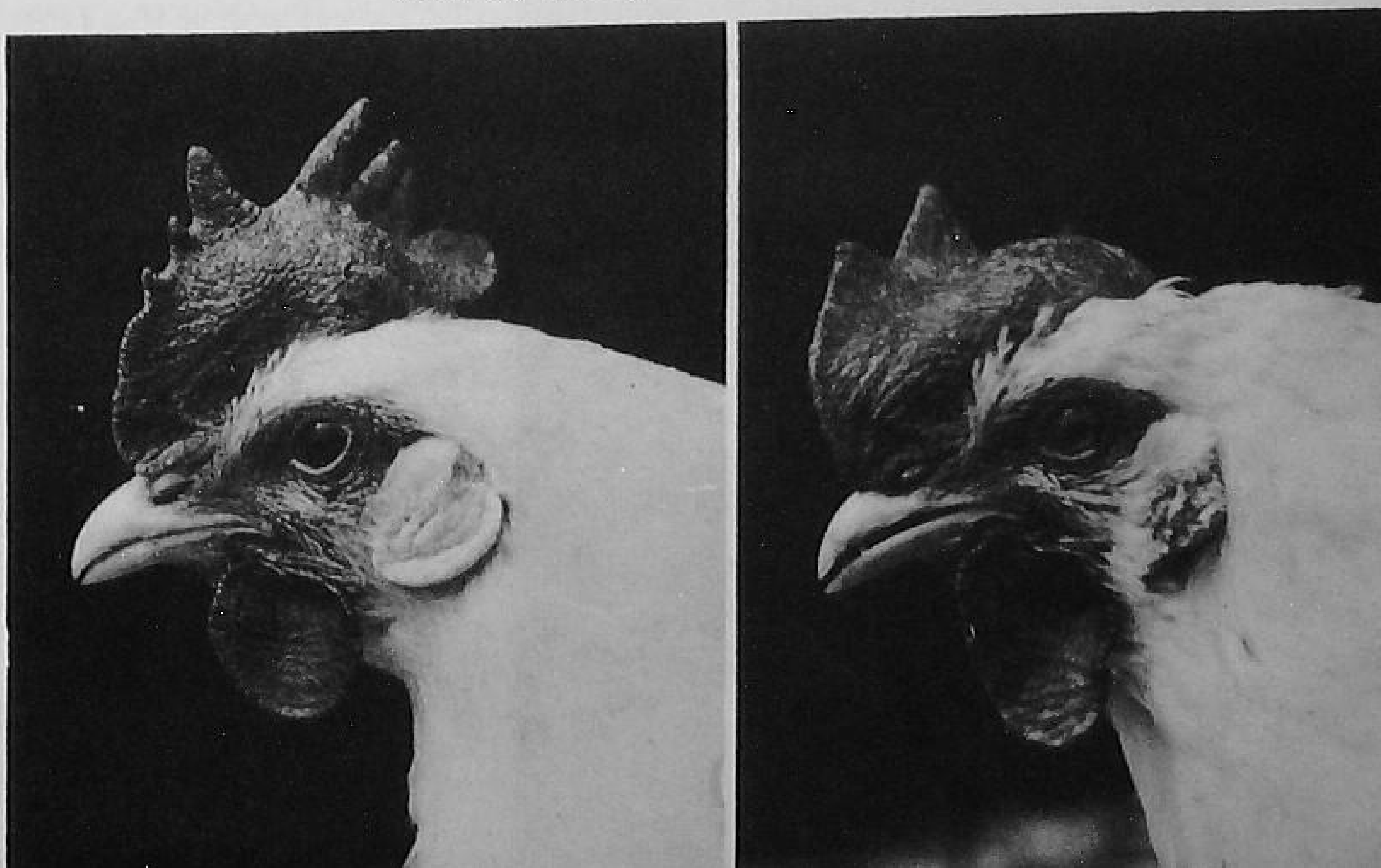


FIGURE 297. *Measuring the space between the pubic bones.* (Courtesy Poultry Tribune.)

FIGURE 298. *Measuring the depth of the abdomen. (center) A good layer. (below) A poor layer.* (Courtesy Poultry Tribune.)

between the pubic bones, which are on either side of the vent. The pubic bones in nonlayers are close together, so there may be room for only one finger between them.

The width of the abdomen is determined by the width between the pubic bones. The depth is measured in terms of the number of fingers which can be placed between the pin, or pubic bones, and the breast bone, or the keel bone. There is room for three or four fingers between these bones on a good layer, while there is space for only one or two fingers on the nonlayer.

Handling quality. The body of a layer is soft and pliable, while that of a nonlayer is hard and contracted. The layer has little fat on its abdomen, while that of the nonlayer may be fatty. Quite often the pubic bones of nonlayers are thickened because of fat.

Condition of the vent. The best way to tell if a hen is now laying is to examine the vent and the distance between the pubic bones. The vent of a layer is large, moist, and oblong. The vent of a nonlayer is small, dry, and round.

Amount of pigment. Many of the common breeds of chickens have yellow skin due to yellow pigment. The color is also evident around the eyes, on the beak, around the vent, and on the shanks. As pullets go into production, this pigment and the pigment in feeds go to produce the yolks of the eggs. The heavier the production, the more pigment that is removed from the bird. An examination of the pigment is an excellent method of telling how long a hen has been laying, or how long she has been out of production.

When a hen begins to lay the pigment leaves the vent rapidly. No pigment will remain after five or six eggs have been laid. A yellow vent is a sign of a nonlayer. A white vent in a yellow-skinned breed indicates that the hen is a layer.

The pigment begins to leave the eye ring shortly after it leaves the vent. After the second week of production, there usually is no pigment remaining in the eye ring. The pigment in the ear lobes of the Mediterranean breeds leaves just a little later.

It takes a longer period of time for the pigment to leave the beak and shanks. The beak begins to fade at the face, and is fully bleached after five to six weeks of production. The shanks lose their color more slowly than the beak, and are not completely bleached until the hen has been in production from four to six months.

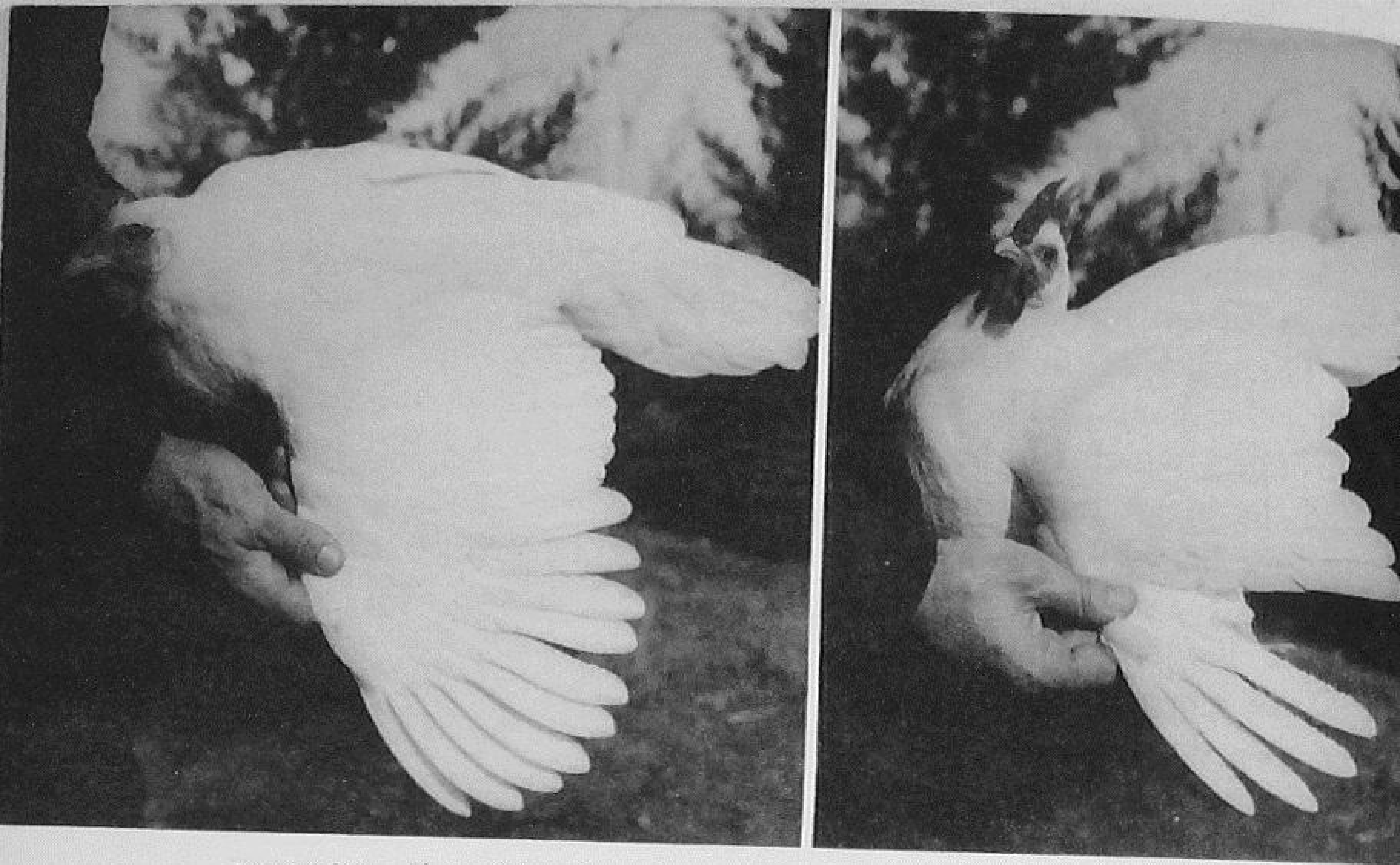


FIGURE 299. *(left) The wing of a hen previous to the start of the molting period. (right) The wing of a hen in process of molting. (Courtesy Oklahoma A & M College.)*

Hens which continue to show yellow pigment should be examined carefully. Sometimes they can be culled on the basis of pigment alone, but it is usually best to consider other factors before marketing the bird.

Stage of molt. Chickens grow new crops of feathers each year. Poor layers shed their feathers, or molt, slowly. Good layers molt rapidly. Poor layers usually begin to molt early in the year, while good layers delay molting until late in the fall. Poultrymen who keep over their pullet flocks for a second year of production, can use molt as a means of selecting the good layers.

An examination of the feathers on a hen will indicate the stage of molt. Feathers are shed in the following order: from the (1) head, (2) neck, (3) breast, (4) body, and (5) wings and tail.

Pullets put into the laying house in the fall should not molt until late the following fall. Pullets which begin molting in May or June should be sold since they go out of production during the molting period, and it takes about three or four months to molt.

The length of time a hen has been out of production can be estimated by counting the number of new primary feathers in the wing. There are ten of these feathers in each wing. The feathers are shed from the axial feather, which separates the primary from the secondary wing feathers, at two week intervals. Slow molters shed one feather at a time. Rapid molters may shed two or three

feathers at a time. It takes about six weeks to grow a new feather. By adding to the six weeks required to produce the first new feather, two weeks for each additional new feather, it is possible to calculate the length of time the bird has been out of production. A hen with three new feathers has been out of production for ten weeks.

Farmers who maintain pullet flocks can make very little use of molt in culling the flock. It is an important factor in selecting hens to hold over for a second year of production.

SUMMARY

Most chickens produced in the United States are of the American or Mediterranean breeds. The Asiatic breeds are grown largely for meat production. The Orpington, Australorp, and Cornish are English breeds produced in this country. Only five breeds of chickens are of commercial importance in this country. They are the White Leghorn, the New Hampshire, the White Plymouth Rock, the Barred Plymouth Rock, and the Rhode Island Red. The other breeds are grown in limited numbers and are used in making crosses.

The production of hybrid and crossbred chicks is increasing. Hybrid chicks are produced by crossing inbred lines of one breed with inbred lines of one or more breeds. Crossbred chicks are produced by crossing noninbred birds of two or more breeds. Crosses of New Hampshire, White Plymouth Rock, Wyandotte and Cornish breeds are popular in broiler production. New Hampshire, White Leghorn, Rhode Island Red, and Minorca breeds are popular in producing laying stock.

Chicks should be ordered early and from a reliable hatcheryman. Only chicks from pullorum free and production tested flocks should be purchased. It is best to buy chicks locally.

Culling is important in poultry production. Baby chicks should be culled when they are placed in the brooder house. Pullets should be carefully culled when they are placed in the laying house. Layers should be culled periodically throughout the year.

Keep only large, well-developed, healthy, hens with large, bright red combs, prominent and bright eyes, and with good body capacity. There should be room for two to three fingers between the pubic bones, and three or four fingers between the pubic bones and the breast-bones.

Layers of the yellow skin breeds should have no pigment around the vent, eye ring, beak, or the shanks. Early and slow molters should be sold. They go out of production during the molting period which may last three or four months.

Buy only high-quality chicks. Keep only the best pullets for laying flock, and cull them periodically. Don't waste feed, labor, and housing on inferior birds.

QUESTIONS

1. What are the major classes of chickens produced in this country?
2. How do these classes differ in conformation and use?
3. Which breeds of chickens are best for egg production?
4. Which breeds are best for broiler production?
5. What is the place of hybrid and crossbred chickens on our farms?
6. What factors must be considered in deciding where to obtain chicks?
7. Does it pay to buy started chicks?
8. Which is better to buy, straight-run or sexed chicks?
9. What factors should be considered in culling laying hens?
10. What type of head, comb and wattles are desired in a laying hen?
11. How can pigment be used in culling a flock of chickens?
12. How can you measure the body capacity of a hen?
13. How can molt be used in culling hens?
14. How many times should a laying flock be culled in a year?

REFERENCES

Card, Leslie E., *Poultry Production*, Lea and Febiger, Philadelphia, 1952.

Charles, T. Burr, and Stuart, H. O., *Commercial Poultry Farming*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Claybaugh, J. H., *How to Select Good Layers*, Extension Circular 1416, University of Nebraska, Lincoln, 1944.

Hayes, J. B., and Annin, G. E., *Get Rid of Boarders Now*, Circular 374, University of Wisconsin, Madison, Wisconsin, 1947.

Jull, Morley A., *Successful Poultry Management*, McGraw-Hill Book Company, Inc., New York, 1951.

Mayer, D. D., *Keep the Layers–Sell the Loafers*, Extension Bulletin 326, Ohio State University, Columbus, Ohio, 1951.

Ware, H. G. and Lasater, H. L., *Culling the Laying Flock*, Circular 449, Oklahoma A & M College, Stillwater, Oklahoma.

Weeks, John P., *The Poultry Profit Guide*, Vulcan Press, Birmingham, Alabama, 1952.

< 31 >

Feeding and Management of the Laying Flock

The spread between the price of eggs and the cost of production has gradually become smaller since about 1929. Poultrymen now must use better laying stock and methods of production in order to have profitable enterprises. A few years ago the United States Department of Agriculture indicated that hens must produce at least 150 eggs per year in order for the poultryman to break even. The average hen in a Nebraska study in 1951–1952 laid 184 eggs at a loss of about 65 cents per hen. Hens in New York which produced an average of 152 eggs lost their owners an average of 25 cents each. Production costs vary from farm to farm, but it appears that hens must produce an average of about 200 eggs per year to be profitable.

METHODS OF INCREASING PROFITS

There are four ways of increasing the profit from our laying flocks: (1) by increasing production, (2) by decreasing production costs, (3) by better marketing, or (4) by using a combination of the three methods just named.

Feed and labor costs make up 75 to 85 per cent of the cost of producing eggs. Feed costs per dozen eggs go down with increased production per hen. Labor costs go down with increases in flock size. In a Pennsylvania study, flocks averaging 241 hens lost their owners 28 cents per hen per year. Flocks averaging 645 birds netted their owners an average of $1.28 per hen, while flocks averaging 1531 hens showed a profit of $1.67 per hen.

A profitable flock should average 50 to 70 per cent production during the entire year. It takes good feeding and management to get this kind of production. One must start out with good pullets, which have to be properly housed. Adequate rations must be provided in proper amounts. Desirable roosting, feeding, water-

FIGURE 300. *Cleaning and disinfecting the laying house. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

ing, and laying equipment must be provided. Adequate lighting and ventilation are essential, and we have to guard against health problems. Careful consideration of these factors may be the key to profitable production on the chicken farm.

MOVING PULLETS TO THE LAYING HOUSE

Pullets of the light breeds will have their hen feathers and red combs, and are ready to start laying when they are about five months of age. Heavy pullets begin laying a few weeks later. Pullets hatched in February should be moved to the laying house in August or early September.

Have the Laying House Clean. Clean the laying house thoroughly a week or two before time to move the pullets. Spray the floor, walls, and equipment with disinfectant. Clean and disinfect the dropping pit, and place new litter on the floor. Clean feeders and waterers, and have them in working condition. Clean and disinfect the nests, and provide new nesting material if it is to be used. If you keep over any old hens, have them in a separate place.

Care of Pullets at Moving Time. Each pullet should be carefully examined at the time it is moved to the laying house. All culls should be removed, and those which are to be kept should be treated for lice with powdered sulphur or sodium fluoride. Try

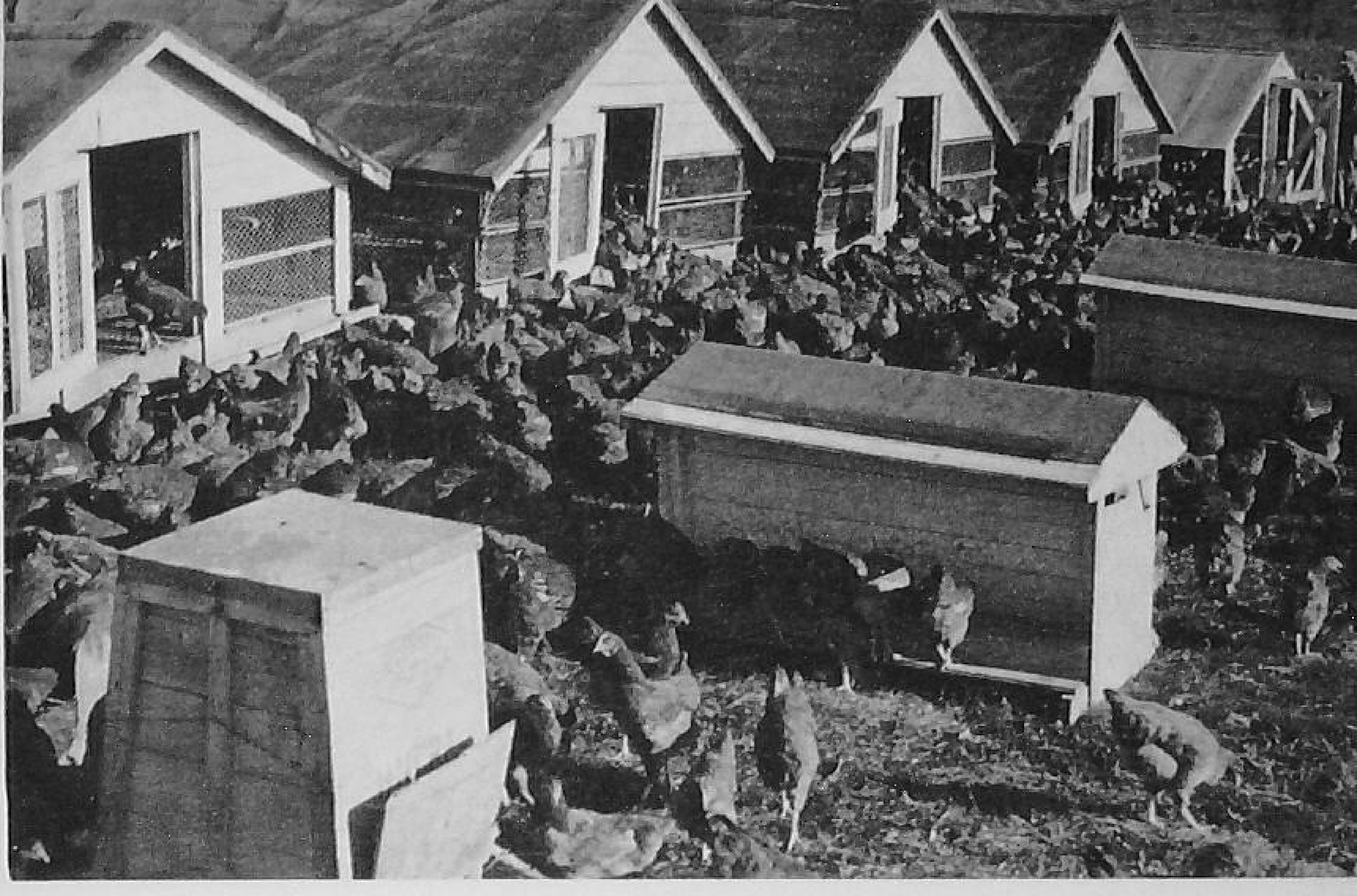


FIGURE 301. *Pullets on range.* (*Courtesy* Hatchery Tribune.)

not to excite the birds at moving time. Watch the pullets the first night or two to see that they roost on the perches rather than on the feeders or nests.

HOUSING THE LAYING FLOCK

The laying house is an important part of the poultry enterprise. Hens are very responsive to their environment, so they need a clean, dry, well-ventilated, quiet, and comfortable house. On many farms the laying house is inadequate and the hens are permitted to have the run of the farmstead. It pays to keep the laying flock confined to the laying house at all times.

Space Required. It does not pay to crowd the hens in the laying house. Three square feet of floor space should be provided for each bird for light breeds, and four square feet for the heavy breeds. Hens do not produce well under crowded conditions, and the house becomes difficult to ventilate properly and keep clean. Crowding may encourage disease outbreaks. A house 20 feet by 40 feet will accommodate about 265 hens (of the light breeds) or 200 heavies.

Roosts. From 7 to 9 inches of roost space should be provided for each bird. A flock of 200 hens will require about 130 feet of roost space. Roosts usually are located at the back of the house, away from drafts. The roosts should be made of 2 x 2- or 2 x 3-

FIGURE 302. *A laying house equipped with a dropping pit.* (*Courtesy* Poultry Tribune.)

inch material and should be placed from 13 to 16 inches apart. Low roosts are preferred.

Dropping Pits. Dropping pits, which are much more satisfactory than dropping boards, should be constructed below the roosts. The pits may be made in sections for ease in cleaning, A pit 16 to 18 inches deep will allow for use of deep litter on the floor. The pit should be closed on all sides with boards or wire, and 1 x 2-inch welded wire should be placed under the roosts to keep the birds out of the pit. The pit will need to be cleaned during hot weather to avoid ammonia injury to the eyes of the hens.

Deep Litter is Recommended. Deep, or built-up, litter is the name applied to a system of litter management which involves the placing of 4 to 6 inches of fresh material on the floor of the house in August or September, and allowing it to build up with droppings and added litter until it is 8 to 12 inches deep. The deep layer of litter is easier to keep dry than a thin layer and has an insulating effect. The floor is warmer and drier. The addition of 1 pound of hydrated lime to 10 square feet of floor space aids the micro-organism action in the litter, thus reducing dampness.

Litter materials. Chopped straw, shavings, ground corncobs, or whole corncobs properly used make good litters. Some poultrymen make a litter of ⅔ ground cobs and ⅓ whole cobs.

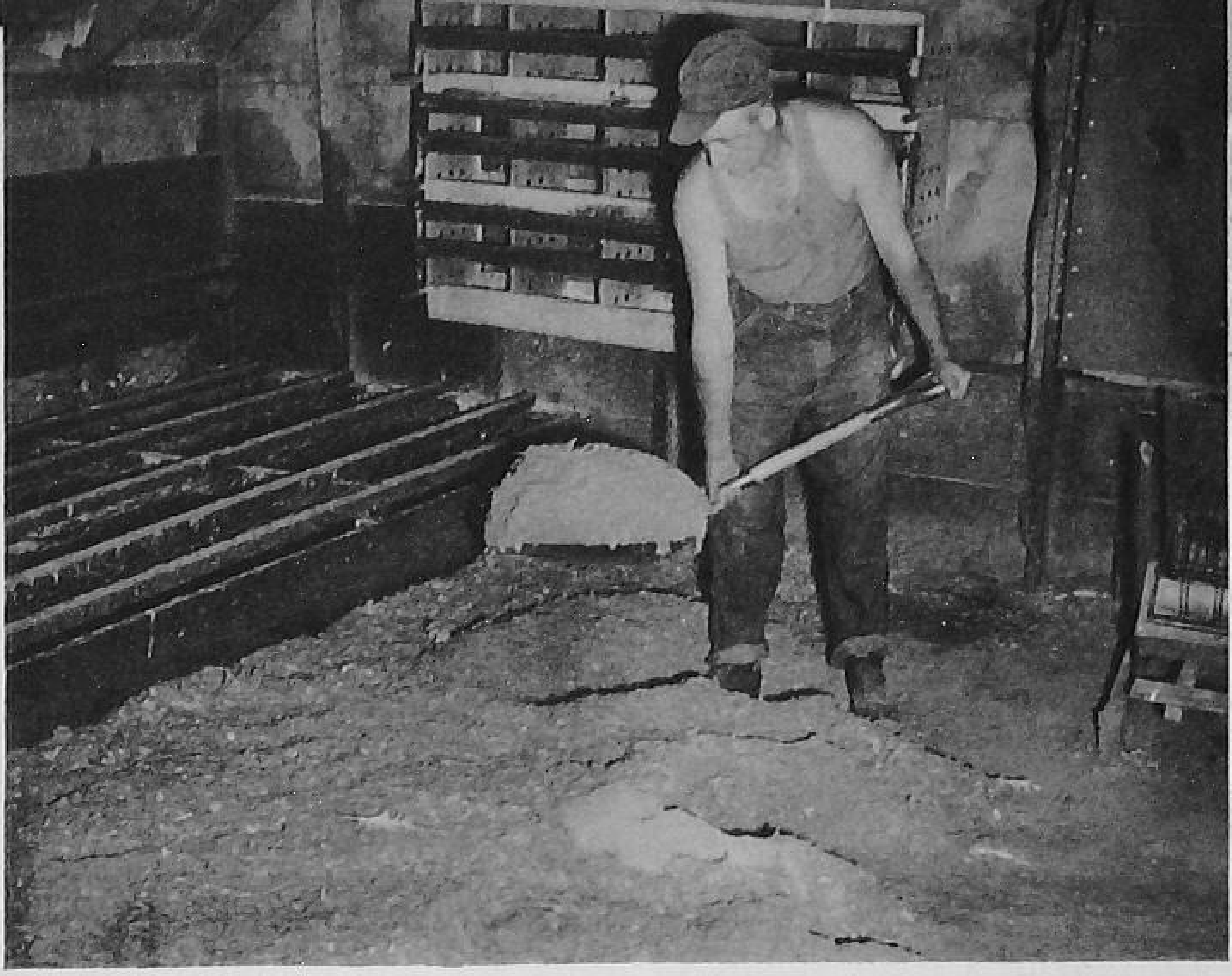


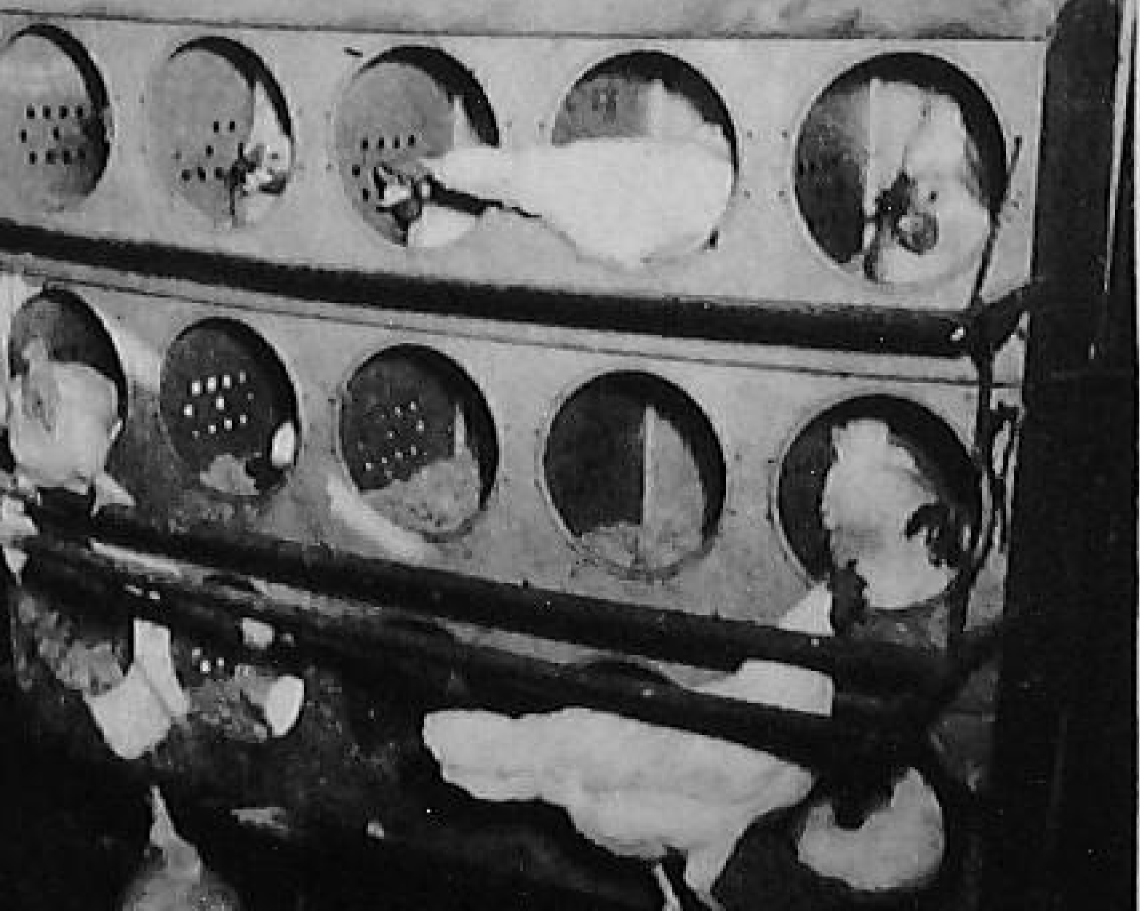
FIGURE 303. *Preparing litter in the laying house.* (*Courtesy* Poultry Tribune.)

Care of litter. The surface of the deep litter should be stirred frequently to prevent matting, but the finely pulverized bottom layer should not be disturbed. The litter should be spread evenly on the floor, and wet material around the waterer should be removed and replaced with new dry material.

Nests. There should be 1 square foot of nesting space for every four or five hens, and the nests should be alike to keep the hens from crowding into certain ones. The number, location, and type of nests affect egg breakage, shell cleanliness, and the labor required in gathering eggs.

The community nest is becoming popular. They are 2 feet wide

FIGURE 304. *(left) Individual nests.* (*Courtesy* Poultry Tribune.) *(right) A community nest with wire bottom.* (*Courtesy* Wallaces' Farmer and Iowa Homestead.)



and from 4 to 12 feet long. Hens enter the nests through eight-inch openings made along one side. One opening is usually provided for each 4 or 5 feet of nest. Eggs are gathered from the front when the openings are in the back. Some nests have hail screen bottoms which slope so that the eggs roll into a trough.

Regardless of the type of nest used, they should have the following features:

1. The inside of the nest is dark.
2. They are easy to keep clean.
3. They provide an easy way to gather the eggs.
4. They are sturdy and easy for the hens to get into.
5. They can be closed at night.

Watering Equipment. A flock of 100 hens will drink from 5 to 7 tons of water in a year. Eggs are about 65 per cent water, so the hens should have ample supply at all times. Automatic waterers will provide a ready supply of water and will eliminate much of the labor required to carry water and fill fountains.

The waterer should be placed on a stand above the litter. A wire platform aids in keeping the water clean. A pendulum guard may be placed over the opening to keep chickens out of it. If water is not piped into the chicken house, air pressure fountains

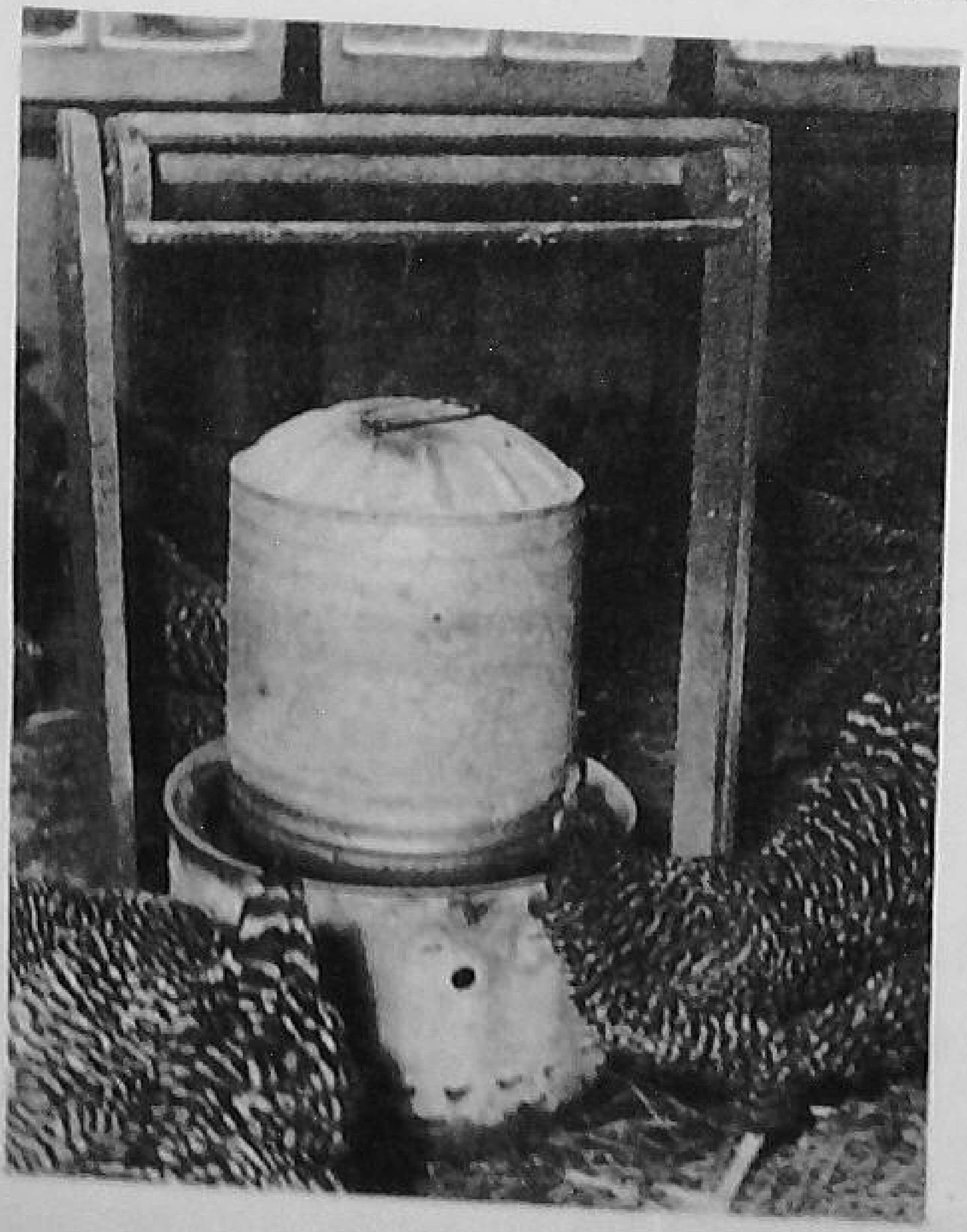


FIGURE 305. *The spindle above the waterer keeps the hens from roosting on it. (Courtesy* Wallaces' Farmer and Iowa Homestead.*)*

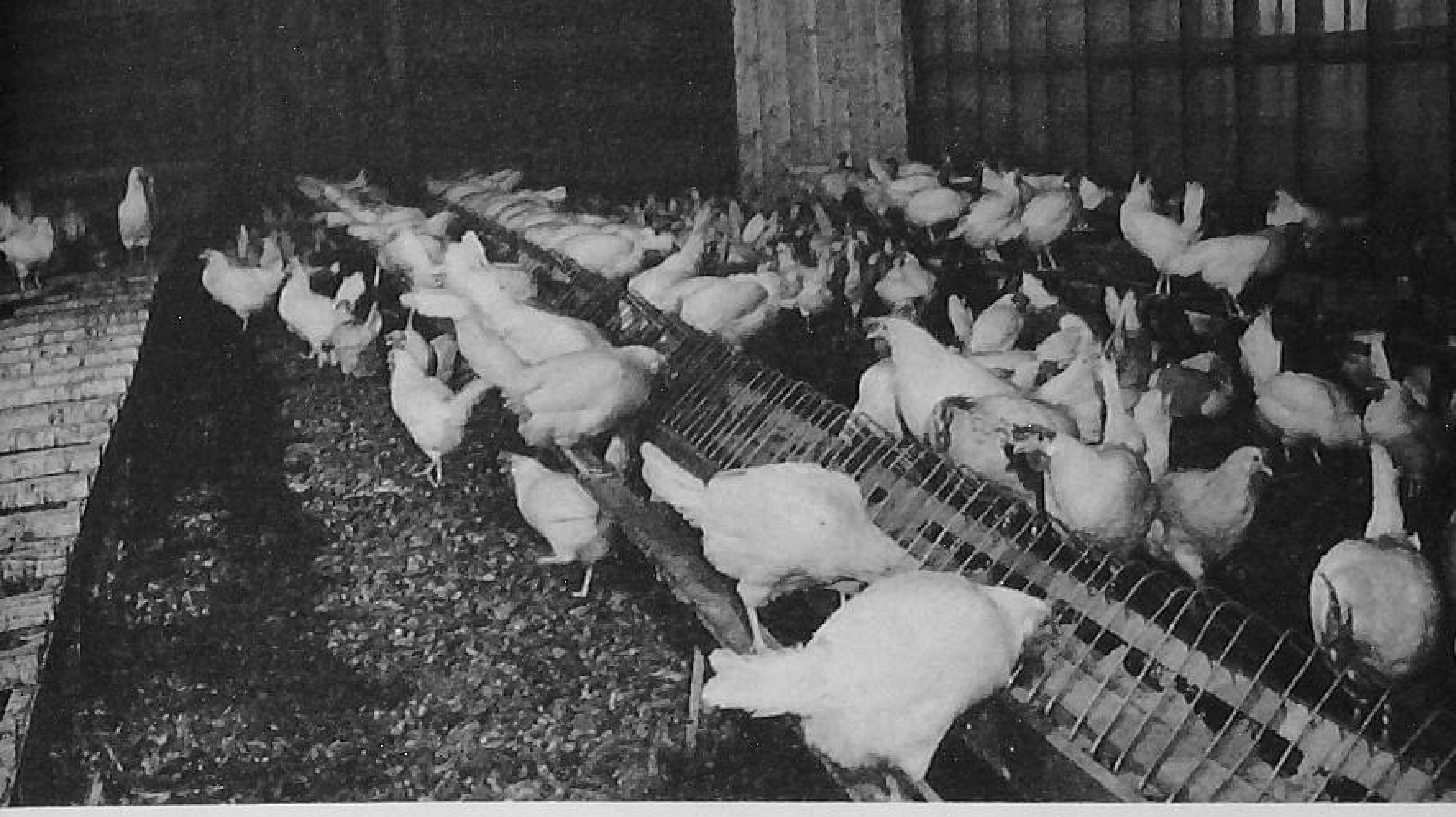


FIGURE 306. *Adequate feeder space is important in laying-flock management. (Courtesy* Poultry Tribune.)

may be used. Two 5-gallon fountains or a 4-foot automatic watering trough should be available for each 100 birds.

Feeders. There should be about 4 inches of feeder space per hen, and the feeders should be about 10 inches above the litter level. It is usually best to have one end of the feeder toward a window so that the feed will not be shaded. All feeders should be at the same height and have reels or grills to keep the feed clean and to prevent waste.

A rack made of lath or of 2-inch poultry netting can be made for use in feeding hay and green feeds. Oyster shell and grit may be fed in small feeders along the wall.

Ventilation. Adequate insulation and ventilation make it possible for poultrymen to control the temperature in the laying house during all seasons of the year. Ventilation is needed to provide fresh air for the hens and to remove the moisture in breathing and droppings. Three to 4 gallons of moisture will be given off by 100 hens in one day.

Slot-type ventilation. A slot ventilator located on the south wall just below the ceiling or eave, and extending the length of the building, is one of the best systems of ventilating the average farm laying house. An adjustable board can be used to regulate the amount of air admitted. The amount of opening will vary with the extent the house is insulated, the outside temperature, and the number of birds in the house.

TABLE 48

SCHEDULE FOR OPERATING SLOT VENTILATORS *

Outside Temperature	*House Temperature*	*Size of Opening*
Below 0° F.	25°–35° F.	¼- to 1-inch opening
0°–30° F.	35°–50° F.	1- to 2-inch opening
30°–65° F.	40°–65° F.	2 inches to full opening
65° and up	50° F. and up	Full opening with windows out

* Bulletin P108 Iowa State College.

Straw loft. The straw loft may be used effectively in many houses. It requires some labor, and may be neglected, but it is an inexpensive method of providing desirable ventilation.

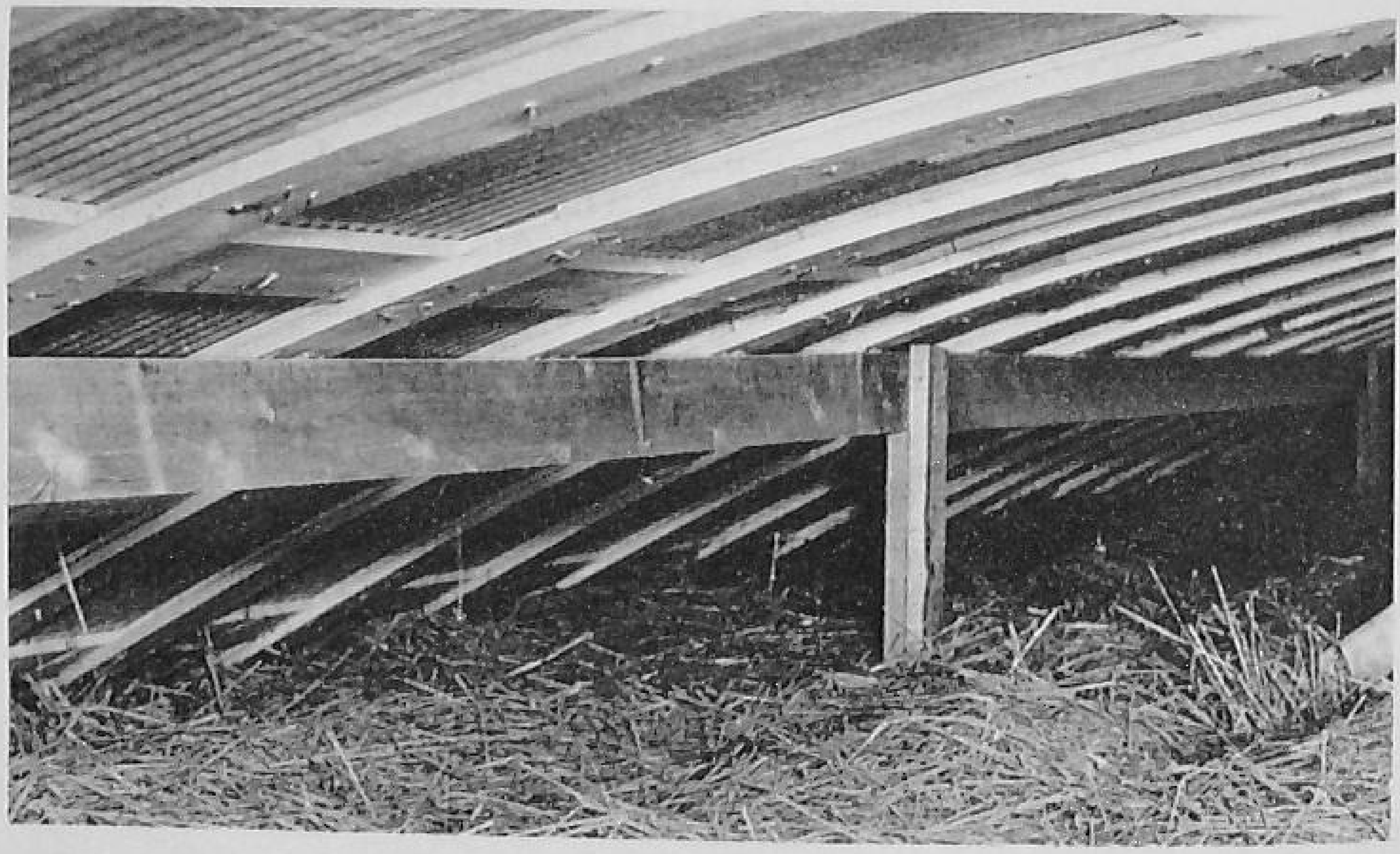


FIGURE 307. *A straw loft in a laying house. (Pease photo. Reprinted from* Successful Farming.)

A layer of straw 1½ to 3 feet deep in the loft of a gable house with open or partially opened windows at either end is recommended.

Flue ventilation. Systems have been developed which are effective. The cost, however, may be questioned.

Lighting. Artificial lights may stimulate egg production during the winter months from October until March. A hen should have a day about thirteen hours long. When there are ten hours of day light, artificial light will be needed for three hours.

Morning light preferred. By providing artificial light in the morning there is no problem of a dimming device to get the birds

FIGURE 308. *A slot ventilator laying house. (Courtesy* Wallaces' Farmer and Iowa Homestead.)

on the roosts at night. Time switches are available which turn the lights on and off automatically. One 40-watt bulb should be used for each 200 square feet of floor space, and each light should have a 16-inch reflector 4 inches deep. The lights should be placed in a row 6 feet above the floor and directly over the feeders.

Types of Laying Houses. Plans for many types of laying houses are available. Those pictured are examples of satisfactory types.

Materials. Laying houses may be constructed of lumber, tile, concrete blocks, or of metal.

Foundation and floor. A 6-inch concrete foundation is needed which will extend 18 to 24 inches in the ground. The floor should also be of concrete laid 2 to 4 inches thick over a layer of gravel. The floor should slope about 1 inch in every 4 feet.

FIGURE 309. *Laying house with tilt-in windows. (Courtesy* Poultry Tribune.)

Roof. A shed or low gable roof is satisfactory.

Windows. One square foot of window space for each 20 to 30 square feet of floor space is ample. Windows may be placed on only one side of houses 28 feet wide or less.

Insulation. Rigid board insulation made of wood or fiber is recommended, due to its excellent insulation quality, ease in construction, and comparative low cost.

FEEDING LAYING HENS

Feed is the most important item of cost in producing eggs. Carefully culled pullets from high production strains will usually produce profitably if they are fed good rations, and are properly housed. Good rations alone, or good laying stock by itself, will not insure good production. Many farm flocks would be capable of producing more eggs than they are now producing, if they were not being fed inadequate rations. Hens use much the same nutrients as other farm animals, but they use them in different proportions and amounts. Hens consume very little roughage and bulky feeds. They need a large amount of protein of high quality, and they require certain vitamins and minerals.

AMOUNTS OF FEEDS NEEDED

The amount of feed needed by a hen depends upon the breed, her body size, her production of eggs, and her environment. A pullet producing an egg every other day uses nearly three-fourths of her feed in maintaining her body, in providing muscular activity, and in maintaining a body temperature of about 107.5° F. About one-fourth of the feed consumed is for egg production.

Heavy Producers Need More Feed. Heavy producing hens need some additional feed for body maintenance and activity but need considerable increases in feeds for egg production. After meeting the maintenance needs, it takes about 1 pound of dry feed to produce each seven eggs.

The high ten flocks of the Iowa Poultry Production Demonstration Flocks[1] in 1951–1952, however, consumed 110 pounds of feed to produce an average of 241 eggs per hen, while the low ten flocks ate 108 pounds but produced only 160 eggs per hen.

Small Hens Need Less Feed. A 5-pound hen requires less feed

[1] Report Iowa Poultry Demonstration Flocks, 1951–1952 Poultry P 906, Iowa State College, 1952.

for maintenance than an 8-pound hen; she is a better converter of feed into eggs. It takes about 24 more pounds of feed to maintain an 8-pound hen a year than is required to maintain a 5-pound hen. The lighter breeds such as the Leghorns and Minorcas, being more efficient than the heavier breeds in converting feed into eggs, are very popular in commercial egg production. Shown in Table 49 are the amounts of feed required by hens of different weights and egg production.

ESSENTIAL NUTRIENTS

Hens in heavy production must receive adequate amounts of the following nutrients: (1) carbohydrates and fats, (2) proteins, (3) fiber, (4) minerals, (5) vitamins, and (6) water.

Carbohydrates and Fats. Chickens are active and have high body temperatures, so they require large amounts of heat and energy producing foods. Corn, oats, barley, wheat, grain sorghums and mill by-products are our chief heat and energy producing feeds. They usually make up from 75 to 80 per cent of the ration.

Availability, price, and quality usually determine the grains to be fed. Yellow corn and oats are popular in much of the Corn Belt, but sorghums, barley, and wheat are fed in many areas. Because hens like variety, the feeding of two or more grains is recommended.

Proteins. Eggs are rich in protein of high quality. If our hens are to produce a large number of eggs, they must receive rations which are high in the amino acids essential in egg production. Since feeds vary in their amino acid content, it is usually desirable to include three or four different protein supplements in the ration. Protein should make up about 15 per cent of the total ration.

Animal proteins. Approximately 25 per cent of the protein in the ration should be of animal origin. Dried, condensed, or liquid skim milk or buttermilk are high in riboflavin and provide protein of high quality. Meat scraps and fish meal of good quality are also excellent sources of animal protein.

Plant proteins. Soybean meal is an excellent source of protein. It is available in most areas and is palatable and reasonable in price. Corn-gluten, peanut, and cottonseed meals are used in some areas. Cottonseed meal when fed in large amounts may produce an objectionable yolk color.

The addition of vitamin B_{12} to a ration will permit a reduction in the percentage of animal proteins.

Fiber. Fiber is not usually considered to be a nutrient, but it has been found that it is essential in the ration for maximum production. The feeding of whole grains and legume hays will provide adequate amounts of fiber.

TABLE 49

AVERAGE AMOUNT OF FEED REQUIRED PER DAY AND PER DOZEN EGGS BY 100 HENS OF DIFFERENT WEIGHTS AND EGG PRODUCTION *

(two-ounce eggs are assumed)

Eggs per 100 Hens per Day	*Feed for*									
	4-Pound Hens		*5-Pound Hens*		*6-Pound Hens*		*7-Pound Hens*		*8-Pound Hens*	
	Per Day	*Per Dozen Eggs*	*Per Day*	*Per Dozen Eggs*	*Per Day*	*Per Dozen Eggs*	*Per Day*	*Per Dozen Eggs*	*Per Day*	*Per Dozen Eggs*
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
0	15.6	—	17.8	—	20.0	—	22.2	—	24.4	—
10	17.0	20.5	19.2	23.2	21.4	25.7	23.6	28.4	25.8	31.0
20	18.5	11.1	20.7	12.4	22.9	13.7	25.0	15.0	27.2	16.4
30	19.9	8.0	22.1	8.8	24.3	9.7	26.5	10.6	28.7	11.5
40	21.3	6.4	23.5	7.1	25.7	7.7	27.9	8.4	30.1	9.0
50	22.8	5.5	25.0	6.0	27.1	6.5	29.3	7.0	31.5	7.6
60	24.2	4.8	26.4	5.3	28.6	5.7	30.8	6.2	33.0	6.6
70	25.6	4.4	27.8	4.8	30.0	5.1	32.2	5.5	34.4	5.9
80	27.0	4.1	29.2	4.4	31.4	4.7	33.6	5.0	35.8	5.4
90	28.5	3.8	30.7	4.1	32.9	4.4	35.0	4.7	37.2	5.0
100	29.9	3.6	32.1	3.9	34.3	4.1	36.5	4.4	38.7	4.6

* Circular 606, University of Illinois.

Minerals. A hen has only about 2 ounces of mineral in her body when she begins to lay, but in producing 200 eggs in a year she puts into them nearly 40 ounces of mineral which is quite largely calcium.

Calcium. The shell of an egg is made up of calcium which must be fed to the hen in the form of oystershell, ground limestone, or steamed bonemeal. Most poultrymen self-feed oystershell, or include mineral feeds in the mash ration.

Phosphorus. Chickens need only small amounts of phosphorus which is available in steamed bonemeal, meat scraps, fishmeal, milk, and in small amounts in farm grains.

Salt. Salt should make up ½ to 1 per cent of the total ration.

Grit. Hens which are fed all-mash rations do not need grit. Those which are fed whole or cracked grains should have hard grit available as a free choice.

Vitamins. Vitamins in small quantities are essential in feeding hens for egg production.

Vitamin A. About 3300 International Units of Vitamin A should be included in each pound of ration. Yellow corn, fresh green forage, alfalfa meal, fortified fish oils, and vitamin A concentrates are the best sources.

Vitamin D. This vitamin is needed by the hens in order to utilize the minerals in the feeds. It should be provided at the rate of 340 International Units per pound of ration. Hens which have access to sunlight can manufacture their own vitamin D. Hens confined to the laying house should be fed fortified vitamin A and D oils, or fed commercially mixed mashes which contain an adequate amount of vitamin D.

Riboflavin. Laying hens should have about 0.9 milligram of riboflavin per pound of ration, while breeding hens need about 1.3 milligrams. This vitamin is available in milk, yeast, liver, and in alfalfa meal. Commercial pre-mixed concentrates containing this vitamin are available. Riboflavin is very essential in the production of hatching eggs.

Vitamin B_{12}. This vitamin when fed with plant proteins permits a reduction in a percentage of animal proteins. It is available in vitamin pre-mixes and in commercially mixed feeds. From 1.5 to 2 micrograms of B_{12} should be provided in each pound of ration.

Water. Water (a pint is contained in each dozen eggs) is essential in poultry feeding, because it permits normal body processes. Keep plenty of clean, fresh water before the hens at all times.

Antibiotics. The feeding of antibiotics to healthy laying hens has not proven profitable. Egg production, hatchability, and feed efficiency were not affected by the feeding of antibiotics.

SYSTEMS OF FEEDING

No combination of farm grains alone will provide the nutrients needed by laying hens in proper amounts. Grains must be supplemented with proteins, mineral, and vitamin feeds. This means that both grain and mash feeds must be fed. Several systems are used in feeding laying hens.

Grain and Mash Feeding. With this method whole grains may be fed in hoppers each evening and mash fed in the mornings, or both types of feeds may be self-fed. The mash should contain approximately 20 per cent protein. In feeding whole grain it should not be spread in a litter; regular feed hoppers should be used instead.

Grain and Protein Concentrate. This system is much like the grain-mash system, but in this system a 26 per cent protein concentrate is self-fed instead of the 20 per cent mash. This method was recommended for use in feeding the Iowa Poultry Demonstration Flocks.

All-Mash Ration. The grain is ground and mixed with the mash feed or with the protein concentrate to make up a complete ration. This system involves more expense in grinding, but a uniform ration results. All hens get the same feeds providing they have been well mixed.

SUGGESTED RATIONS

The following may be guides in planning rations for your home flock. In formulating rations, figure the content of the ration in relationship to the nutritional needs of the hens. Calculate the cost of a pound of protein, and of a pound of the total ration.

TABLE 50

Laying and Breeding Mash Formulas *

Ingredient	*20% Protein* (lbs.)	*26% Protein* (lbs.)
Corn, ground yellow	632	148
Oats, ground whole	100	
Wheat bran	150	200
Wheat middlings, standard	150	200
Steamed bonemeal or defluorinated phosphate	100	150
Iodized salt	18	18
Ground oyster shell or limestone	20	40
Manganese sulfate	2	2
Alfalfa meal, dehydrated	200	300
Meat and bone scraps (50%)	200	300
Soybean meal (42%)	300	500
Dried milk	100	100
Vitamin D (2000 A.O.A.C. units per gram)	2	2
Riboflavin concentrate (500 micrograms per gram)	20	30
Vitamin A (3000 I.U. per gram)	6	10
Total	2000	2000

* Bulletin P 108, Iowa State College.

TABLE 51

GRAIN MIXTURES

Grain	*Ration* 1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)
Yellow Corn	50		33.3	40.0		25.0
Oats	50	33.4	33.4	30.0	30.0	25.0
Wheat		33.3			30.0	25.0
Grain sorghum		33.3			40.0	
Barley			33.3	30.0		25.0

TABLE 52

MASH AND GRAIN DIETS FOR LAYING HENS *

Diet 1	*Parts by Weight*	*Diet 2*	*Parts by Weight*
MASH:		MASH:	
Finely ground oats	10.0	Ground yellow corn	16.5
Wheat middlings	15.0	Ground wheat	15.0
Ground yellow corn	16.0	Finely ground oats	15.0
Soybean meal	32.0	Soybean meal	25.0
Alfalfa leaf meal	8.0	Meat scraps	5.0
Riboflavin supplement †	5.0	Alfalfa leaf meal	8.0
Steamed bone meal	5.5	Riboflavin supplement †	2.5
Ground limestone ‡	6.5	Ground limestone ‡	6.0
Manganized salt §	1.0	Steamed bone meal	5.0
Iodized salt ‖	.4	Manganized salt §	1.0
Vitamin A and D feeding oil ¶	.6	Iodized salt ‖	.4
		Vitamin A and D feeding oil ¶	.6
GRAIN MIXTURE:		GRAIN MIXTURE:	
Whole yellow corn	50.0	Whole yellow corn	50.0
Wheat	50.0	Oats	25.0
		Wheat	25.0

* Farmers Bulletin No. 2052, USDA.
† Containing at least 15,000 micrograms of riboflavin per pound.
‡ Neither oyster shell nor limestone grits should be fed with these diets.
§ A mixture of 100 parts common salt and 5 parts technical anhydrous manganous sulfate.
‖ The standard commercial product is recommended.
¶ Should contain 300 International Units of vitamin D, and at least 1,500 International units of vitamin A, a gram.

CANNIBALISM

The picking of each other by hens is referred to as *cannibalism.* Occasionally hens, in attempting to lay too large an egg, will rupture the oviduct, or a part of the cloaca will protrude from the vent. Hens see this soft, red membrane and pick at it. The intestines may be pulled out before it is noticed by the caretaker. Cannibalism can also be caused by inheritance, by deficiencies in

FIGURE 310. *Attaching metal appliance to prevent cannibalism. (Courtesy* Poultry Tribune.)

the ration, and by close confinement. Once hens get in the habit of picking at each other, it is difficult to stop, and heavy losses may result.

Prevention. The following are some of the best methods of preventing cannibalism:

1. Cut off from one-fourth to one-third of the upper beak.
2. Purchase and attach metal appliances to the beaks as the pullets are placed in the laying house.
3. Allow plenty of feeder and floor space.
4. Provide good ventilation.
5. Feed fresh green feeds or dry, green alfalfa hay.
6. Feed whole oats to growing pullets and to laying hens.
7. Darken windows and nests.
8. Delouse birds and disinfect quarters.

RECORDS

The merchant on main street discontinues the handling of any item which does not show a profit, unless he has to carry the item to get other business. He keeps records of his business and they are carefully analyzed. Poultrymen need to do the same thing. There is no way of telling how much profit is obtained from the laying flock if no records are kept. Neither is it possible to deter-

mine methods of cutting down production costs. Good business methods must be applied to egg production as in any other enterprise.

Kinds of Records. The following records will be valuable in analyzing the enterprise:

1. Inventories of birds, equipment and feeds at the beginning and at the close of the laying period. A monthly check of hen numbers is necessary.
2. Egg production records by days and by months.
3. A record of mortality of death loss by months.
4. A record of income from sales and products used at home.
5. Feed records by months.
6. Records of cash expenditures.

Use of Records. A carefully kept set of records is of no value unless it is used. The following summary included in the *Iowa Poultry Demonstration Flocks in 1951–1952* indicates the type of analysis which should be made of the records and the use of them.

TABLE 53

Summary of Data on Laying Flocks

Iowa Poultry Demonstration Flocks, 1951–1952

Items	*Average of 46 Flocks*	*10 High-Labor Income Flocks*	*10 Low-Labor Income Flocks*
Average size of flock	380	274	291
Average eggs per hen	203	240	161
Percentage of mortality and theft	29.0	24.6	40.2
Flock investment ($)	2116.96	1321.24	2674.12
(*a*) Investment per hen ($)	5.58	4.82	8.76
Actual flock expense ($)	1572.48	1083.98	1350.99
(*a*) Expense per hen ($)	4.14	3.95	4.43
Pounds of feed per hen	108	106	114
(*a*) Pounds of feed per dozen eggs	6.5	5.2	8.2
Average price paid for eggs ($)	.41	.41	.41
Average cost per dozen ($)	*.34	*.23	*.40
Hours labor per hen	.7	1.0	1.0
Flock labor and interest earned ($)	702.02	858.79	108.49
Interest charge at 6 per cent ($)	167.71	79.24	124.53
Net income for labor ($)	591.75	828.30	−16.04
(*a*) Net income per hen ($)	1.56	3.00	−.52
(*b*) Net income per hour ($)	1.66	2.99	−.52
Sources of receipts per hen			
(*a*) Market eggs ($)	6.10	8.17	4.63
(*b*) Market poultry ($)	.94	1.05	1.52
(*c*) Hatching eggs ($)	1.25	—	1.68
(*d*) Total receipts per hen ($)	8.32	9.25	7.73
Management score	18.1	19.1	16.1

* Based on labor income per hen.

SUMMARY

We can increase egg profits by increasing production per hen, by reducing production costs, by use of better marketing methods, or by use of a combination of these methods. Feed and labor costs make up from 75 to 85 per cent of production costs. Feed costs per dozen eggs go down with increased production per hen. Labor costs go down with increased size of flock. A flock should average 180 to 200 eggs per hen per year to make a profit.

Pullets should be carefully culled and deloused before putting them in the laying house. The laying house should be thoroughly cleaned and disinfected. New litter should be placed on the floor and equipment prepared for use. Pullets should be housed when about 5 months of age.

Allow 3 to 4 square feet of floor space, 7 to 9 inches of roost space, and 4 to 5 inches of feeder space per bird. Provide a deep litter and dropping pits. A 5-gallon waterer should be provided for each fifty hens. Use community nests with 1 square foot of nesting space per bird.

Insulate the house and provide straw-loft or slot ventilation. Provide 1 square foot of window space for each 20 to 30 square feet of floor space. Provide artificial lights to lengthen the day to about thirteen hours.

A ration containing 15 per cent protein should be fed to hens. The self-feeding of grain and mash is recommended. Two or three kinds of grain are to be fed. Hens will consume about equal parts of 22 per cent protein mash and grain; their consumption is about 110 pounds of feed in a year. Grains should make up about 75 per cent of the ration.

Included in the mash ought to be at least three protein feeds, with one of them of animal origin. Soybean meal, meat scraps, and dried milk is a good combination. Hens need vitamins A and D which may best be supplied in a pre-mix supplement. Vitamin B_{12} is especially needed when the ration is lacking in animal protein.

Hens must be provided with oyster shell, ground limestone, and salt. Riboflavin is especially needed in producing hatching eggs. The feeding of antibiotics to laying hens has not proven helpful in increasing production or in decreasing costs.

QUESTIONS

1. How many eggs does the average hen on your farm have to lay to produce a profit?

2. How many square feet of floor space should a Minorca hen have in the laying house?
3. What rules do you need to follow in providing feeders, roosts, nests, and waterers?
4. What are the advantages and disadvantages of a dropping pit?
5. What are the advantages of deep litter?
6. How much more feed does it take to maintain a hen which produces 230 eggs than one which produces 150 eggs in a year?
7. What part of the total ration should be made up of protein?
8. Which of the farm grains make the best feed for laying hens? Why?
9. Is an all-mash ration better than a grain-mash ration? Why?
10. Should laying hens be self-fed or hand-fed?
11. Plan a ration and feeding program for your flock.
12. Outline a program for improving the housing of your home flock.

REFERENCES

Card, L. E., *Practical Poultry Feeding*, Circular 606, University of Illinois, 1951.

Cook, Cora, *Poultry Housing*, Extension Bulletin 121, University of Minnesota, 1952.

Eggleton, L. Z., *et al.*, *Pullet Flock Management*, Bulletin P 108, Iowa State College, 1950.

Goodman, A. M., *Homes for Laying Hens*, Extension Bulletin 451, Cornell University, 1952.

Iowa State College, *Laying House Equipment*, Pamphlet 171, 1952.

Mayer, D. D., and Blickle, J. D., *Poultry Housing in Ohio*, Bulletin No. 303, The Ohio State University, 1950.

Titus, Harry W., *The Scientific Feeding of Chickens*, The Interstate Printers and Publishers, Danville, Illinois, 1949.

United States Department of Agriculture, *Better Feeding of Livestock*, Farmer's Bulletin No. 2052, 1952.

< 32 >

Feeding and Management of Young Chickens

The raising of young chickens up to an age of three or four months for meat poultry as broilers and fryers, or for replacement of the laying flocks, is an important phase of poultry production. Baby chicks are obtained and raised on practically every farm in the nation, and some commercial producers feed out thousands of broilers each year.

The methods used in feeding and managing young chickens vary somewhat according to the number being raised and the use to be made of them, but the principles involved are much the same. Chicken raising is profitable only under certain conditions. The chicks must be healthy and bred for production. They must be housed properly with adequate space, heat, and sanitation. The ration must provide the nutrients necessary for rapid and economical growth. Mortality must be kept to a minimum, and the health of the chicks must be protected from diseases and parasites.

The selection of chicks was discussed in Chapter 30, and the control of diseases and parasites will be explained in Chapter 34. We present in this chapter the principles and best practices in housing, brooding, feeding, and managing young chickens.

BROODER HOUSES

A satisfactory brooder house must be capable of maintaining the desired temperature under the hover, regardless of weather conditions. It must provide space, for the brooder and areas away from the brooder, which will be cool. It should be tightly constructed, yet provide for ventilation. Windows should be provided, but an excess of sunlight should be avoided. It is difficult to maintain even temperatures in houses with large window areas on the south.

The floor and walls of the house should be such that they can

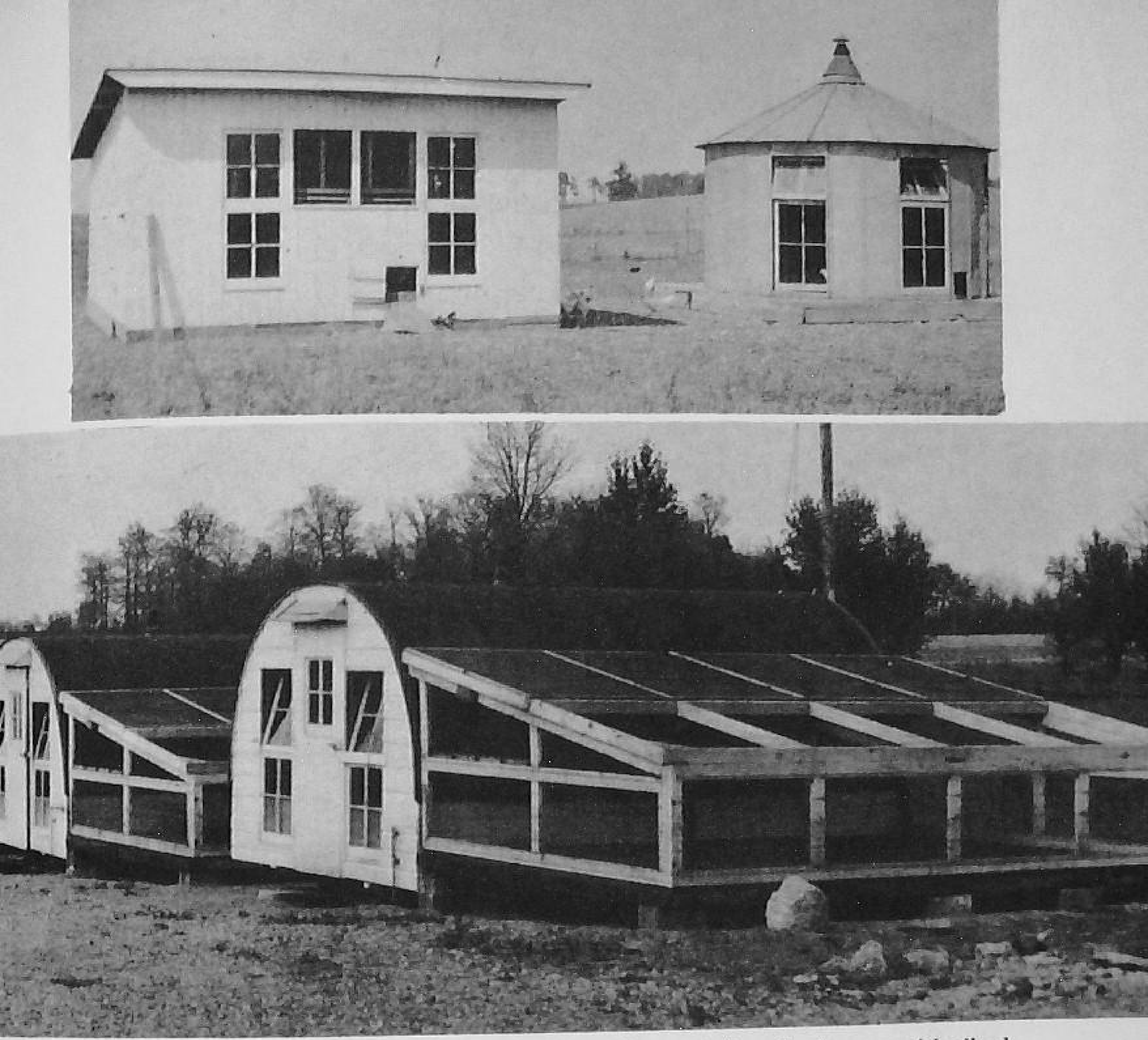


FIGURE 311. *(top) Types of brooder houses. (bottom) Brooder houses with tilted floors and sunporches. (Courtesy* Poultry Tribune.)

be cleaned and disinfected easily. A portable house set on skids is desirable, since it can be moved to a clean range.

Size of House. In most cases it is not desirable to brood more than 350 chicks in one lot. A house 12 x 14 feet will accommodate a 56-inch hover and provide the recommended 7 square inches of hover space per chick. There should be 1 square foot of floor space for each two chicks during the first month. Each chick should have 1 square foot of floor space during the second month, and 1½ square feet the third month.

Getting the House Ready for Chicks. Clean the brooder house thoroughly several weeks before the chicks arrive. Sweep the walls and ceiling, and scrape the floor. Scrub the lower walls and floor with hot water, and disinfect with lye water (one 13-ounce can to 15 gallons of water), or with a 5 per cent chlorine solution. Give the house plenty of time to dry out before using it. Clean

FIGURE 312. *Chicks confined to the brooder area by a chick guard. (Courtesy Poultry Tribune.)*

and disinfect the feeders and fountains at the same time, and have the house and equipment free of diseases and parasites.

LITTER

A good litter on the floor serves as an insulator in maintaining uniform temperature and as a blotter in absorbing moisture. Litter should be fairly coarse to permit the droppings to sift through to the floor. Shavings or ground corncobs make excellent litters. Hay chaff is satisfactory if it is not moldy or dusty.

A layer of from 3 to 4 inches of litter should be placed on the floor a day or two before the chicks arrive, and it should be piled up in the corners so the chicks will not do it. Litter should be stirred up two or three times each week to permit drying and to avoid matting. When new litter is needed, it should be placed on top of the old. It may be built up to a depth of from 6 to 8 inches.

BROODER AND MANAGEMENT

The brooder should be set up and put into operation a few days before the chicks arrive. It must be properly regulated. The temperature two inches above the litter near the edge of the hover should be from 90° to 95° during the first week.

Kinds of Brooders. Coal or oil brooders heat the houses as well as the areas under the hovers. The temperature under the hover

can be maintained a little lower with these brooders than with gas or electric brooders.

Gas or electric brooders heat the hover area but not the room. The temperature under the hover should be maintained at 95° to 100° at the start. Many poultrymen like these brooders because of their ease of operation.

Brooder Management. Ideal brooding conditions provide ample heat for the chicks under the brooder, but the rest of the house is comparatively cool.

Chick guard. During the first few days a guard made of cardboard, wood, or sheet metal from 15 to 18 inches high and from 8 to 12 feet long should be placed around the hover at a distance of about 2 or 3 feet to keep the chicks from getting away from the brooder and becoming chilled. The guard also helps to keep out drafts and cold air.

Decrease temperature. The temperature can be reduced gradually about 5° each week until is down to about 75° or 80°.

STARTING THE CHICKS

Feed and water should be available for the chicks when they are placed in the brooder house. The first feed for pullorum free chicks may be placed on paper or on new egg case flats. Chicks must learn to eat and drink. Ordinarily chicks are ready to eat in about eighteen to twenty-four hours after hatching. It is important that they receive feed within thirty-six hours after being hatched.

Feeders and Waterers. Small lath troughs may be used as feeders during the first week or ten days. The troughs should be kept filled. One inch of trough space should be provided for each baby chick for the first five weeks. Several small water fountains should be used during the first few days. Four ½-gallon fountains will provide adequate water for 100 chicks.

After a week or ten days the lath troughs should be replaced with 3 x 6-inch troughs. Two inches of feeder space per chick is recommended after the fifth or sixth week.

Large feeders which are elevated should be provided when the chicks are from eight to ten weeks of age. Three-gallon waterers should be used, and they should be placed on wire-covered platforms that are 6 inches high. Most chicks will be out on range by the time they are from eight to ten weeks of age, and can be

FIGURE 313. *Larger feeders and waterers are provided when chicks are about ten days old. (Courtesy* Poultry Tribune.)

fed with the use of protected outdoor feeders. At least one feeder should be left indoors for use during rainy weather.

NUTRITIONAL NEEDS OF CHICKS

Chicks require rations containing about 20 per cent protein during the first few weeks, and the protein must be of high quality. Baby chicks have little capacity and cannot consume coarse or bulky feeds. Most poultrymen feed a commercial starter feed. Large commercial producers may need a sufficient volume of starter feeds to justify mixing their own rations. Starter and growing mashes are formulated which meet the nutritional needs of the chicks. Proteins, carbohydrates and fats, mineral, vitamins, and antibiotics are essential for rapid and economical chick growth.

Proteins. The muscular tissue produced in chick and broiler production is quite largely made up of protein. The body of a 5-pound Leghorn cockerel is about 25 per cent protein. Starter and growing mashes must be high in proteins, containing at least thirteen of the amino acids. Arginine, lysine, methionine, tryptophane, and cystine may be critical in some rations. To guard against protein deficiency, include three or four different protein supplements in the ration. About 25 per cent of the protein should be of animal origin. Milk products, meat scraps, fish meal, soybean meal, and corn gluten meal are good feeds to include in the chick mash.

Carbohydrates and Fats. The cereal grains—corn, wheat, oats, barley, and grain sorghums—are usually used to provide carbohydrates. The use of two or three grains in the mash is recommended, and they should be ground.

After the chicks are from five to six weeks old, they should be fed cracked corn, or whole small grains in feeders, or as scratch feed in addition to the mash. Eight-week-old chicks should receive about 90 per cent mash feeds and 10 per cent scratch grains. By the time they are three months old, the grain ration should make up 30 per cent of the total ration. Four-month-old birds should get about equal amounts of scratch and mash feeds.

Mineral. Common farm feeds contain most of the minerals needed by chicks, with the exception of calcium, phosphorus, sodium, chlorine, and manganese. Calcium is easily supplied in ground limestone or marine shells. Phosphorus may be supplied in the form of steamed bone meal, defluorinated rock phosphate, or as meat and bone meal. Salt provides sodium and chlorine. Manganese must be purchased in a drug store as technical anhydrous manganous sulfate.

Starter mashes should contain about 1 per cent calcium, 0.6 per cent phosphorus, 0.5 per cent salt, 0.2 per cent potassium, 25 milligrams per pound of manganese, and 0.5 milligrams per pound of iodine.

Vitamins. Vitamins are very essential for rapid and economical chick growth. Vitamins A and D, riboflavin, niacin, pantothenic acid, and choline may be most critical in the ration.

Vitamin A. According to the Committee on Animal Nutrition of the National Research Council, chicks should receive rations containing 2000 International Units of vitamin A per pound. This vitamin promotes growth and infection resistance in chicks. Green feeds, yellow corn, and fish oils are our best sources.

Vitamin D. This vitamin promotes efficient use of calcium and phosphorus and prevents rickets in chicks. About 135 International Units per pound of ration is recommended. Late-hatched chicks grown in the sunlight can produce their own vitamin D.

Riboflavin. Riboflavin is needed for chick growth and should be provided at the rate of 1.6 milligrams per pound of ration. Liver, yeast, milk products, and fermentation by-products resulting from the manufacture of lentyl alcohol are best sources.

Niacin. Chicks need niacin for normal growth and develop-

ment. They lose their appetites and become nervous when this vitamin is lacking. Niacin may be supplied in liver, yeast, and fermentation by-products. Wheat bran and middlings contain niacin, and it can be purchased in crystalline form. For chicks, 8.0 milligrams of niacin is recommended per pound of ration.

Pantothenic acid. There should be 5 milligrams of pantothenic acid in each pound of chick rations. This vitamin prevents dermatosis, aids feathering, promotes normal pigmentation, and is essential for healthy nerves. Succulent green feed, alfalfa meal, milk products, yeast, and liver meal are good sources.

Choline. Chicks should receive about 700 milligrams of choline per pound of ration. It prevents perosis or slipped tendon conditions. Fish and animal products, soybean meal, and distillers' solubles are main sources of this vitamin.

Other vitamins. Several other vitamins are essential, but they are usually available in the feeds included in the ration. Vitamin K (an antihemorrhagic), biotin, or vitamin H (dermatosis preventive), and pyridoxin (an appetite and growth stimulant) are examples.

Antibiotics. Chicks respond to antibiotics in much the same manner as pigs. They grow more rapidly on less feed when fed antibiotics, and the growth stimulation is greatest during the first few weeks. Chicks fed antibiotics in Ohio were 12.1 per cent heavier at twelve weeks of age, and consumed 5 per cent less food, than chicks which were not fed antibiotics.

Kinds. Aureomycin, bacitracin, penicillin, and terramycin have all been effective in promoting growth at a level of approximately from 1 to 4 grams per ton of ration. There is some evidence that penicillin produces the greatest growth increases.

When to feed. Antibiotics are most effective during the first few weeks, but some increases are noted up to ten or twelve weeks. Antibiotics should be fed in the chick mash until the chicks are ten or twelve weeks of age.

Sources. Best sources are vitamin pre-mixes or the feeding of a commercially mixed starter feed which contains antibiotics.

Arsenicals. The feeding of arsenilic acid, 3-nitro-4 hydroxyphenyl arsenic acid, and other arsenicals have shown growth stimulating properties. When chicks were fed both antibiotics and arsenicals, even greater increases in growth resulted. These matrials are toxic and must be fed with caution, because they are still

in an experimental stage. Follow directions carefully if you feed them. There is some evidence that arsenicals show greater increases when fed to unhealthy chicks.

Surfactants. The feeding of surface active agents, or wetting agents, to chicks is in process of experimentation. Illinois tests showed no increases due to surfactants when fed to chicks on a good ration containing aureomycin. Cornell University tests showed growth increases when surfactants were fed both during the first and second four weeks periods. They found, however, that penicillin was a better growth stimulator than any of the surfactants studied.

RATIONS FOR CHICKS

Many farmers rely upon commercial feed concerns for their chick rations. The materials needed can be purchased in large quantities by mixing firms, and they can put out a high quality product at a reasonable price if they care to do so. Studies must be made of the contents of the various starter and grower mashes, and selection should be based upon the extent to which the feeds meet the nutritional needs of chicks, and upon cost.

CHICK STARTERS

Mash No. 1
(Nebraska Extension Circular 1496)

	Pounds
Yellow cornmeal	400
Soybean meal	224
Ground oats	100
Shorts or bran	100
Meat scraps	50
Alfalfa meal (17%P)	50
Fish meal	25
Dried whey	25
Ground limestone	16.6
Iodized salt	8.2
Manganese sulphate	.2
Act. animal sterol (1500 IC units vitamin D per gm)	1
Antibiotic feed Supplement (Follow manufacturers directions)	
Vitamin concentrate (Follow manufacturers directions)	
Total	1000
Average protein	20.8%

Mash No. 2
(Illinois Circular 606)

	Pounds
Ground yellow corn	669
Pulverized oats	400
Ground wheat	200
Alfalfa meal	100
Soybean meal (41%P)	360
Meat and bone scraps (50%P)	200
Dried whey	60
Dried vitamin D (1500 units per gm)	.4
Iodized salt	10
Manganese sulfate	.6
Approximate total	2000
Calculated analysis:	
Protein, per cent	20
Calcium, per cent	1.2
Phosphorus, per cent	.86

(Antibiotics should be added to the above rations.)

GROWING MASHES

Mash No. 1
(U.S.D.A. Farmers Bulletin No. 2052)

	Pounds
Ground yellow corn	32
Finely ground oats	10
Wheat middlings	10
Wheat bran	5
Soybean meal	28
Fish meal	3
Alfalfa leaf meal	5
Riboflavin supplement	2.7
Steamed bone meal	2
Ground limestone	1.2
Manganized salt	1.0
Vitamin A & D feeding oil	.1
Total	100

Mash No. 2
(Minnesota Extension Bulletin 176)

	Pounds
Ground yellow corn	325
Wheat bran	100
Middlings or ground wheat	200
Ground whole oats	100
Alfalfa leaf meal	50
Meat scrap	75
Soybean oil meal	125
Dried milk	15
Salt	10
Total	1000

(Antibiotics should be fed with these rations until the chicks are 10 to 12 weeks old.)

Farmers usually have home-grown grains available and may wish to have their chick feeds mixed at the local elevator, using home grown grains, vitamin-mineral-antibiotic pre-mixes, and other commercial feeds. The starting mashes above are suggested for chicks.

RANGE SHELTERS

The brooder house usually will not accommodate the chicks as they acquire a little size. Portable range shelters should be pro-

FIGURE 314. *A range shelter with roosts and feeders along the sides. (Courtesy V. J. Morford, Iowa State College.)*

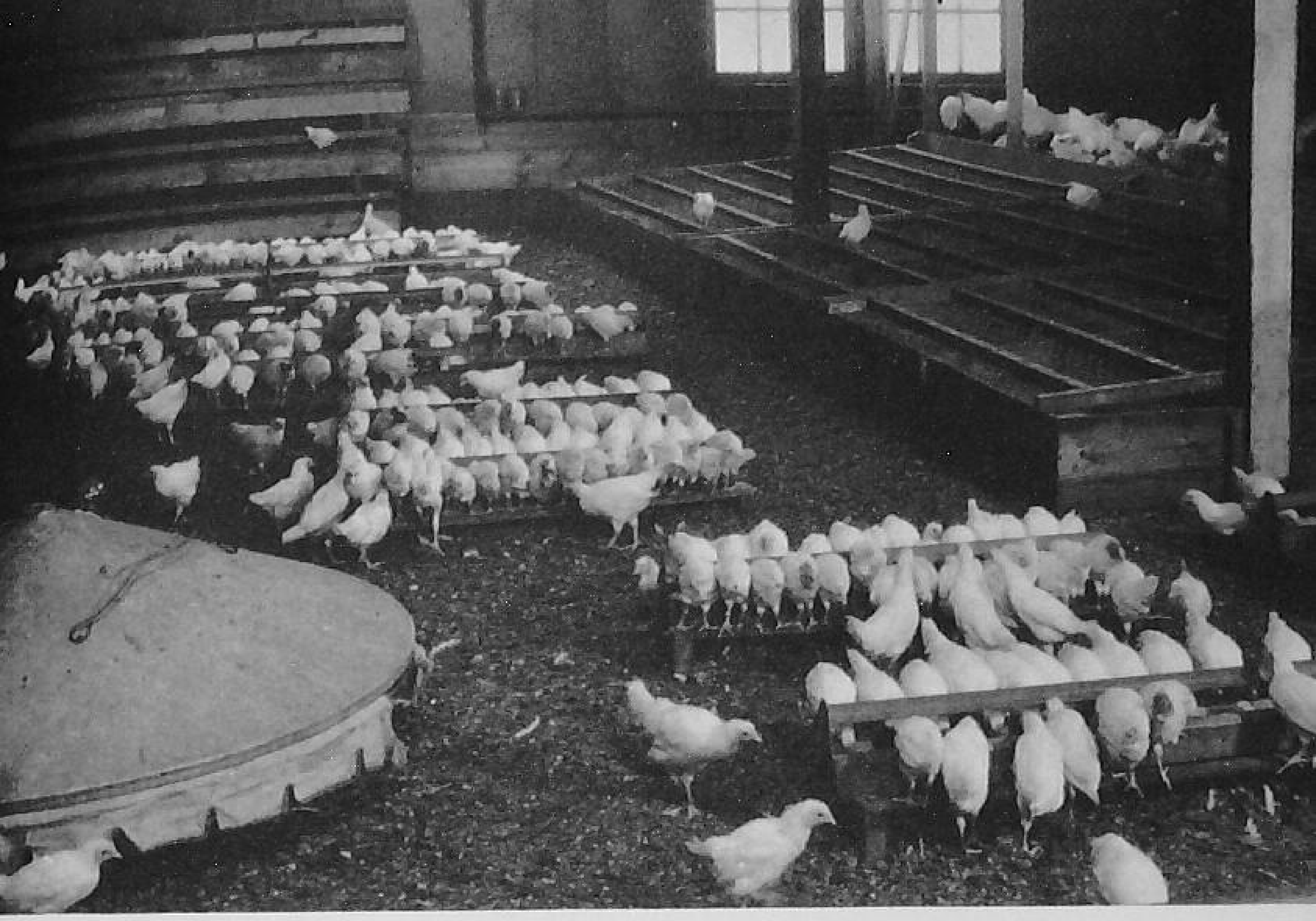


FIGURE 315. *Chicks need roosts when from four to six weeks of age. (Courtesy* Poultry Tribune.)

vided. Shelters enclosed with wire netting will permit the confining of chickens at night to avoid losses due to predators.

The range shelter may also be used as a sun porch in caring for the baby chicks. Some poultrymen grow their chicks for the first eight weeks in the brooder house using the range shelter as a sun porch.

ROOSTS

Chicks will begin to roost at about six weeks of age. Roosts should be placed along the back of the brooder house. Perches should be placed low at the beginning and raised after the chicks have learned to roost. Placing a frame covered with wire netting under the roosts aids in getting the birds on the roosts. Placing roosts level with the floor avoids the tendency for chickens to get to the top roosts.

Wide flat roosts are recommended. They prevent chicks from developing crooked breast bones.

CANNIBALISM

Cannibalism in chicks may cause serious losses and the pullets may continue picking each other after being placed in the laying house. The same factors are involved in preventing cannibalism in chicks as were discussed in connection with the laying flock.

Avoid crowding, overheating, and insufficient feeder and water space. Use a sun porch to increase floor area.

Feeding finely ground oats to young chicks, or coarse-ground or whole oats to older chickens may help. Adding salt up to about 4 per cent of the mash for a few days may give good results. Remove injured and crippled chicks as soon as they are discovered.

SEPARATE COCKERELS FROM PULLETS

Many poultrymen separate the cockerels from the pullets when 6 to 8 weeks of age. The pullets are put on range while the cockerels are fed broiler ration and sold. Leghorn cockerels will use as much feed putting on a pound of weight after 2½ pounds as was required to put on the first 2½ pounds. It pays to separate the cockerels of the light breeds and dispose of them at 2½ pounds as broilers.

RANGE FOR CHICKENS

Chicks should be moved to range at eight weeks of age. Be certain to provide clean ground on which no chickens have been grown for at least two years.

Ladino clover, lespedeza, alfalfa and red clover make excellent pasture crops for young chickens. From 10 to 30 per cent of the feed can be saved by providing good range. Provide movable equipment and move it from time to time to maintain sanitary quarters. Provide plenty of fresh water and keep the feeders filled.

FIGURE 316. *Excellent range and housing for young chickens. (Courtesy* Poultry Tribune.)

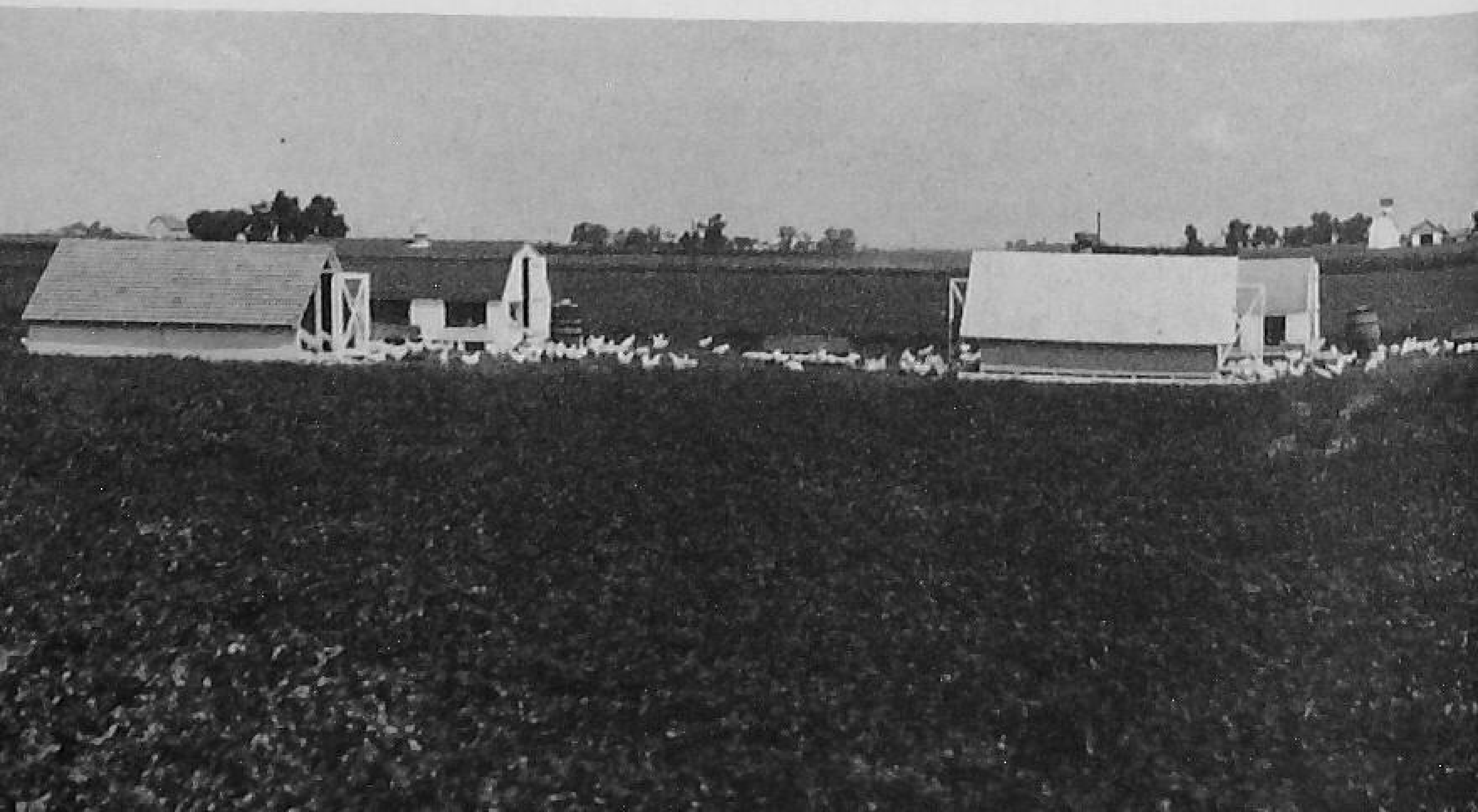


FIGURE 317. *A large-scale broiler enterprise.* (*Courtesy* Broiler Growing.)

BROILER PRODUCTION

The feeding and management of broilers is quite similar to the methods used in starting and growing out chicks, with the exception that the latter are kept in confinement until they are sold.

During the winter months ¾ to ⅘ of a square foot of floor space per bird is recommended. One square foot per bird is desired in the summer.

The feeders, waterers, and deep litter recommendations for chick production apply also in the production of broilers.

Broiler Rations. Most broiler producers feed starting mashes for the first eight weeks, and some continue feeding an all-mash ration until the birds are sold. Others start feeding pellet feeds or cracked corn with mash at eight weeks and continue until the broilers are ready for market. Grain feeding slows up rate of gain but permits the feeding of home grown grains.

Antibiotics for broilers. According to USDA Farmers' Bulletin No. 2052 one to four milligrams of antibiotics should be fed with each pound of feed. Antibiotics induce a 10 per cent increase in growth rate to 10 weeks of age and save about 10 per cent of feed. One milligram of procaine penicillin or 4 milligrams of other antibiotics per pound is the recommended feeding level.

Following are broiler mashes containing antibiotics:

Mash No. 1
(USDA Farmers Bulletin No. 2052)

	Lbs.
Ground yellow corn	59.7
Alfalfa leaf meal	5
Soybean meal	17
Peanut meal, corn gluten meal or soybean meal	5
Fish meal	5
Meat meal	6
Butyl fermentation Solubles (250 micrograms riboflavin per grain)	.6
Manganized salt	.5
Vitamin A & D feeding oil	.2
Antibiotic supplement (1 Milligram procaine penicillin or 4 milligrams other antibiotics per pound of feed)	
Total	100

Mash No. 2
(Nebraska Extension Circular 1496)

	Lbs.
Yellow cornmeal	500
Soybean meal	317
Meat scraps	50
Alfalfa meal (17%P)	50
Fish meal or fish soluble blend	25
Ground limestone	8.3
Iodized salt	8.2
Steamed bonemeal	8.3
Manganized sulphate	.2
Act. animal sterol (1500 IC units of Vitamin D)	1
Antibiotic Feed Supplement (Follow manufacturers directions)	
Vitamin Concentrate (Follow manufacturers directions)	
Total	1000
Average protein	23%

CAPONETTES AND CAPONS

The implanting of synthetic female hormones in young cockerels produces caponettes. The removal of the male organs produces capons.

Caponettes. Stilbesteral pellets implanted under the skin of the

FIGURE 318. *Implanting stilbesteral pellets under the skin in the neck.* (Courtesy Poultry Tribune.)

neck at the back of the head causes the cockerels to become quiet, lose their male characteristics, and take on the appearance of a pullet. Cockerels are usually treated when eight to ten weeks old and sold when twelve to sixteen weeks old. The treatment lasts only four to six weeks, so if they are not sold they take on male characteristics again.

The hormone treatment causes the bird to become plump and fat. It can be marketed before it has reached maturity, and it will have an excellent carcass. The treatment costs but a few cents per bird.

Capons. A capon must be kept six to nine months before it is ready for market, and six or seven pounds of feed are required to produce a pound of meat. On the market capons compete with turkey, thus causing the capon business to have little promise in most areas.

Cockerels are caponized when they weigh 1½ to 2 pounds, and the caponizing is usually done by a specialist. While many farmers have done some caponizing, the job is for a person who does the work sufficiently often to become skilled.

The removal of the testicles in a cockerel produces a bird with the appearance of a pullet. They grow larger and meatier, but it requires many months to produce a good capon. Two pounds of broiler meat can be produced on the amount of feed needed to produce a pound of capon. The price of capon usually is not twice the price of a broiler.

RECORDS

A careful record of chicken and broiler production, income, expense, mortality, feed consumption, and rate of gain will assist in developing a profitable enterprise. The following is a summary of a broiler project completed in Oklahoma in 1950–1951*:

Breed–New Hampshire	No. started–1200
Date started–Sept. 22	Age sold–9 weeks, 2 days
Number raised–1150	No. culls–0
Pounds raised–3048	Ave. wt.–2.65
Per cent that died–4.16	Pounds of feed fed–8000
Meat produced per 100 lbs. feed–38.1	Cost of chicks–14¢
Cost of litter–$5.50	Cost of fuel–$40.00
Cost of Medicine–0	Cost of feed–$348.00
Total cost–$558.50	Sales price per pound–22¢
Total sales–$670.45	Production cost per pound–$0.1833
Return per bird raised–$0.1072	

* Circular 555, Oklahoma A & M College.

SUMMARY

Get chicks started early. Obtain production bred chicks. House the chicks in a cleaned and disinfected brooder house. Provide 3 to 4 inches of good litter. Brood no more than 350 chicks in one lot. Give each chick 7 square inches of hover space. Have a sun porch for the chicks after they are a few weeks old. Keep the hover temperature at 90° to 95° the first week. Reduce the temperature about 5° each week until it is down to 75° or 80°.

Feed a 20 to 21 per cent chick starter. Provide 1 inch of feeder space per chick at the start. After four or five weeks use larger feeders and provide 2 inches of space. Give chicks plenty of water.

Feed antibiotics to chicks, using penicillin at the rate of 1 milligram per pound of ration, as recommended.

Provide wide roosts for chicks at four to five weeks, in order to prevent crooked breasts. Move chicks to range at eight weeks, and use range shelters. Change ration to a grower mash plus grain. Use such good grains as cracked corn, oats, sorghum, wheat, and barley. You will have excellent pasture with ladino, lespedeza, alfalfa, and red clover.

Chicks need about the same vitamins and proteins needed by laying hens. Surfactants will not take the place of antibiotics, The feeding of arsenicals, which are toxic, is as yet experimental.

Hormones implanted in cockerels produce caponettes which gain rapidly and produce excellent carcasses. Capon production competes with turkey production. It takes twice as much feed to produce a pound of capon as it takes to produce a pound of broiler.

QUESTIONS

1. How much of the following should be provided per baby chick: (*a*) floor space? (*b*) feeder space? (*c*) waterer space? (*d*) hover space?
2. What temperature is desired under the hover during the first week?
3. Outline the essentials of a good starter feed.
4. What kind of litter is recommended for chicks and broilers?
5. What vitamins are most critical in formulating chick rations?
6. Does it pay to feed chicks surfactants and arsenicals?
7. How can you best provide antibiotics for your chicks?
8. Outline a program for feeding and managing chickens on range.
9. In what respects are the methods of feeding and managing broilers

different than those used in growing out breeding chickens or laying pullets?

10. What methods can you use to prevent cannibalism in young chickens?
11. Which will be most profitable on your farm—raising broilers, roasters, capons, or caponettes?

REFERENCES

Annin, G. E., and Cravens, W. W., *Chicks, Brooding, Feeding and Rearing*, Circular 382, University of Wisconsin.

Aubol, W. F., *Poultry Rations and Feeding*, Extension Circular 1496, University of Nebraska.

Card, L. E., *Practical Poultry Feeding*, Circular 606, University of Illinois.

Cook, Cora, *A.B.C. of Chicks*, Extension Bulletin 176, University of Minnesota.

Hurd, L. M., *Rearing Chickens*, Bulletin 152, Cornell University.

Norris, L. C., *Antibiotics, Arsenicals, and Surfactants in Poultry Nutrition*, Proceedings Nutrition Council, American Feed Manufacturers Association, 1952.

United States Department of Agriculture, *Better Feeding of Livestock*, Farmers' Bulletin, No. 2052.

Ware, H. G., and Phagan, C. V., *Broiler Production in Oklahoma*, Circular 555, Oklahoma A & M College.

Winner, E. B., *Chick Brooding and Rearing*, Circular 581, University of Missouri.

< 33 >

Turkey Production and Management

Turkey production has become a highly specialized industry. More than 90 per cent of the nation's turkeys are produced on 19,153 farms, according to census figures. Approximately 10 per cent of the turkeys are produced on 143,000 other farms which produce less than 200 birds each. Nearly 75 per cent of our turkeys are grown on farms which have more than 1600 birds.

Few turkey raisers maintain breeding flocks. Turkey poults are usually purchased from specialized producers who maintain high quality breeding flocks and hatchery facilities. The problems encountered by the average turkey grower are concerned with the obtaining of high quality poults, the management of the poults during the brooding and range feeding periods, the control of diseases and parasites, and with the marketing of birds which have been produced. This chapter will deal with the problems in production and management. Marketing problems will be considered in Chapter 35.

BUY GOOD POULTS

The same factors need to be considered in buying poults that were considered in buying chicks, but their importance is magnified because of the higher prices paid for poults and received from the sale of market turkey.

Selection of Variety. The most popular varieties of turkeys are the Broad Breasted Bronze, the White Holland, and the Beltsville (U.S.D.A.) Small White. Other varieties grown in small numbers are the Bourbon Red, Narragansett, Black Slate, and the Jersey Buff. Nearly 80 per cent of the turkeys produced in this country are of the Bronze varieties. The Broad Breasted Bronze has become very popular as a heavy turkey, and the Beltsville Small White is popular as a broiler turkey.

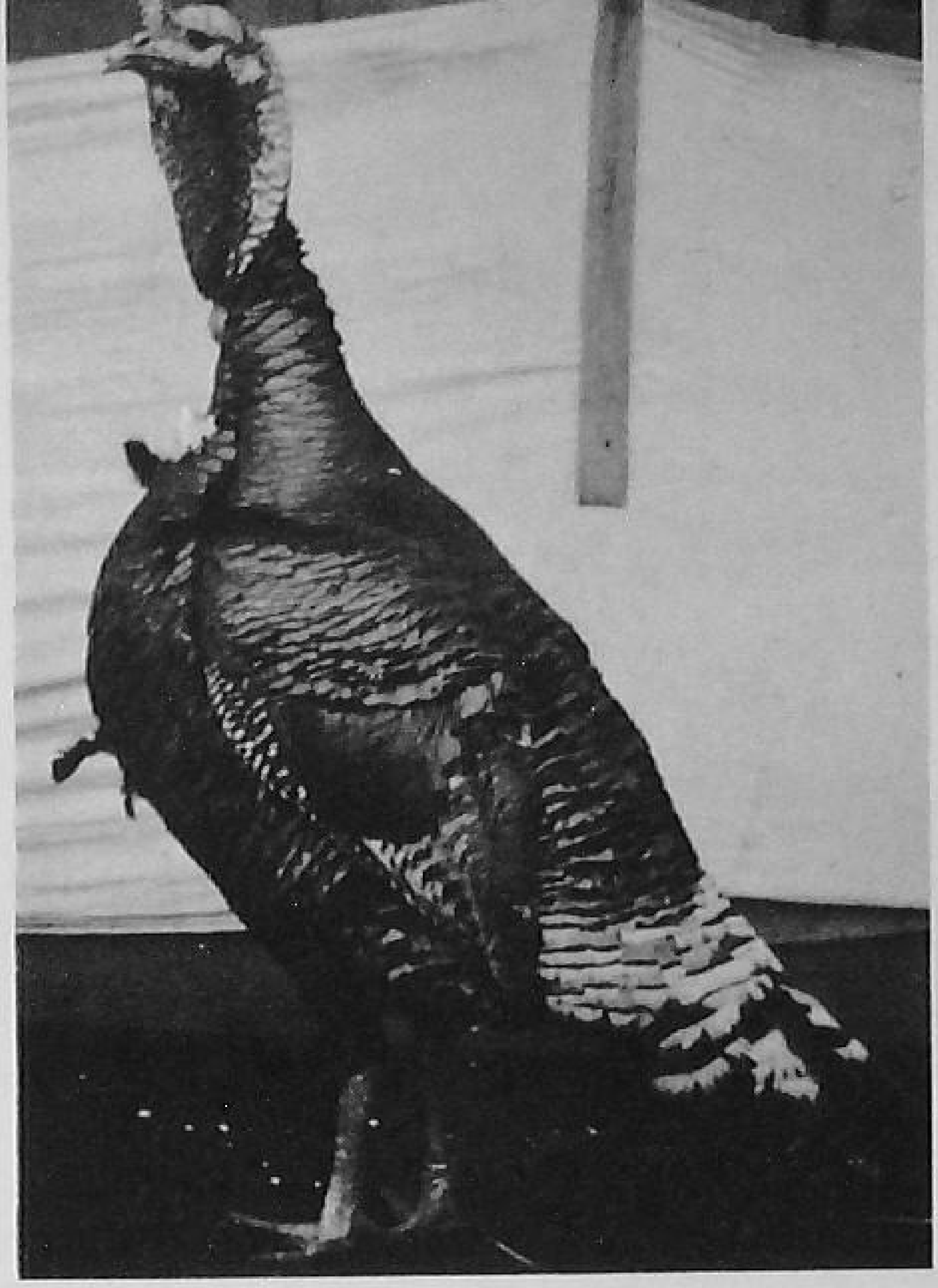
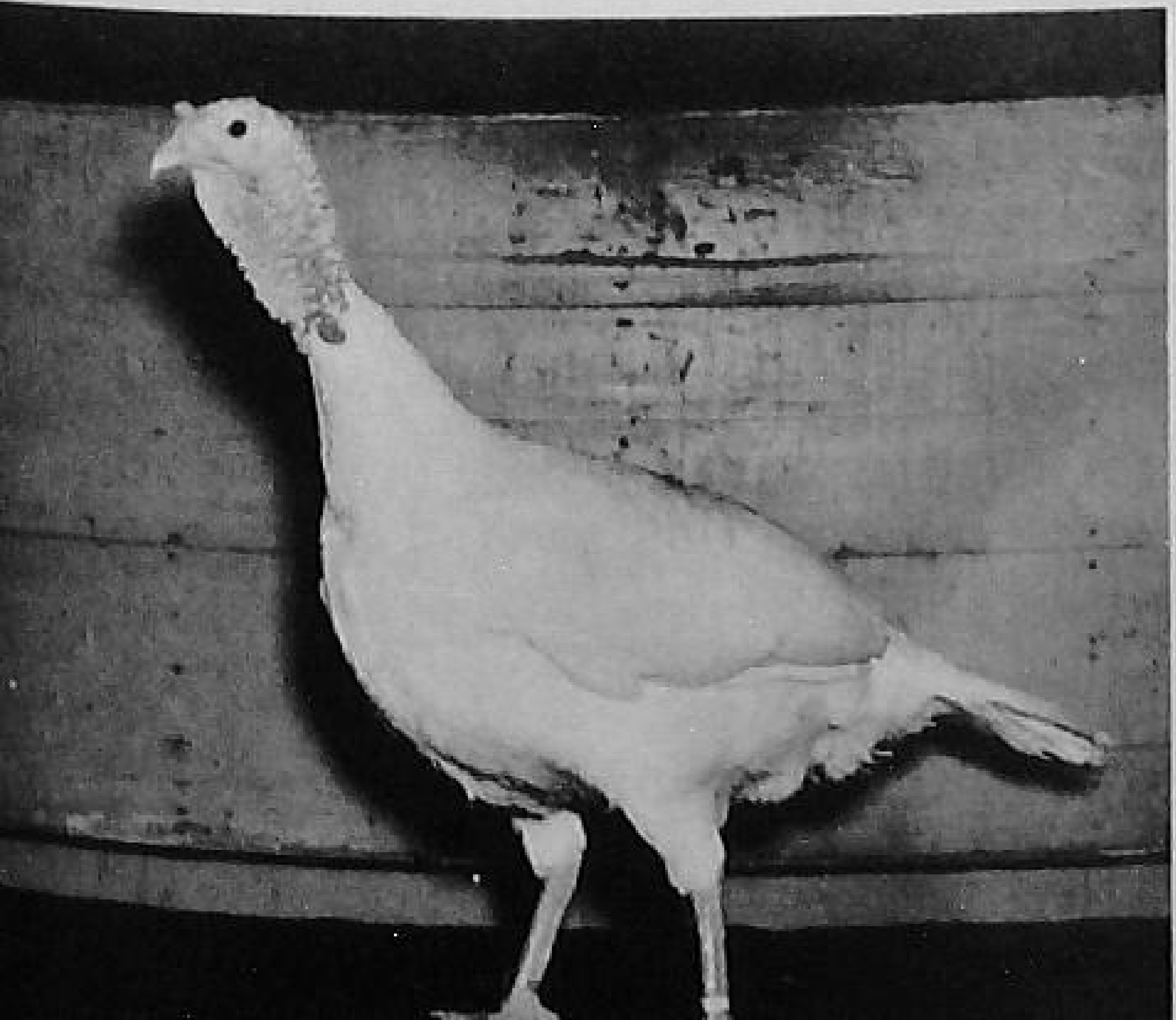


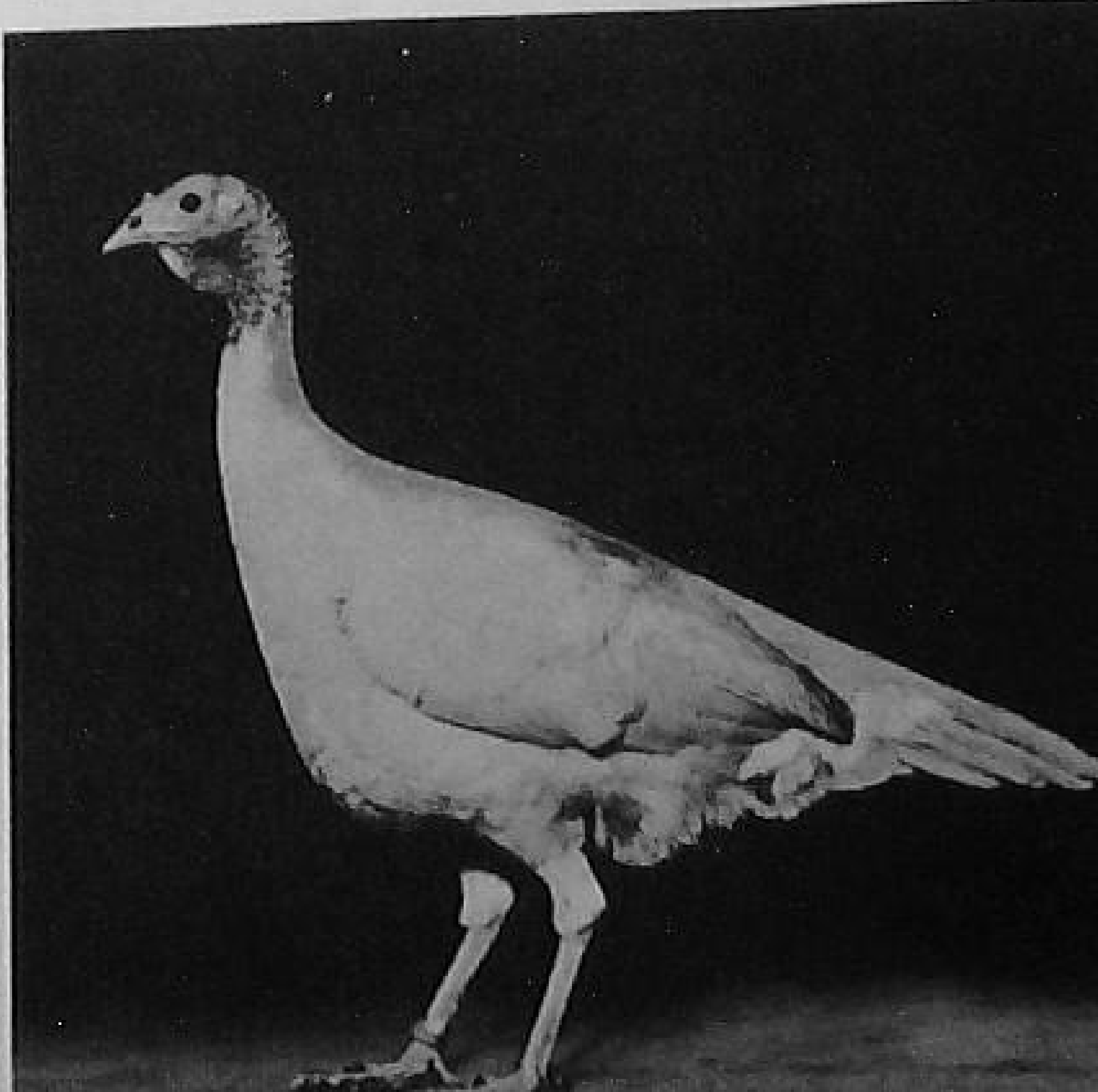
FIGURE 319. *Broad Breasted Bronze turkey.* (*Courtesy* Turkey World.)

In setting up a turkey business, the grower should choose the variety that is best suited to his market, is available in the desired quality and quantity, and can be purchased at the best price.

Production Bred. Poults should be purchased from flocks where pullorum control programs have been followed and where meat production has been stressed. Thrifty, disease-free poults are essential to success. When possible, poults nearby should be bought in order to avoid overheating and chilling in transporting them.

FIGURE 320. *(left) White Holland turkey.* (*Courtesy* Turkey World.)
FIGURE 321. *(right) Beltsville Small White turkey.* (*Courtesy* Turkey World.)





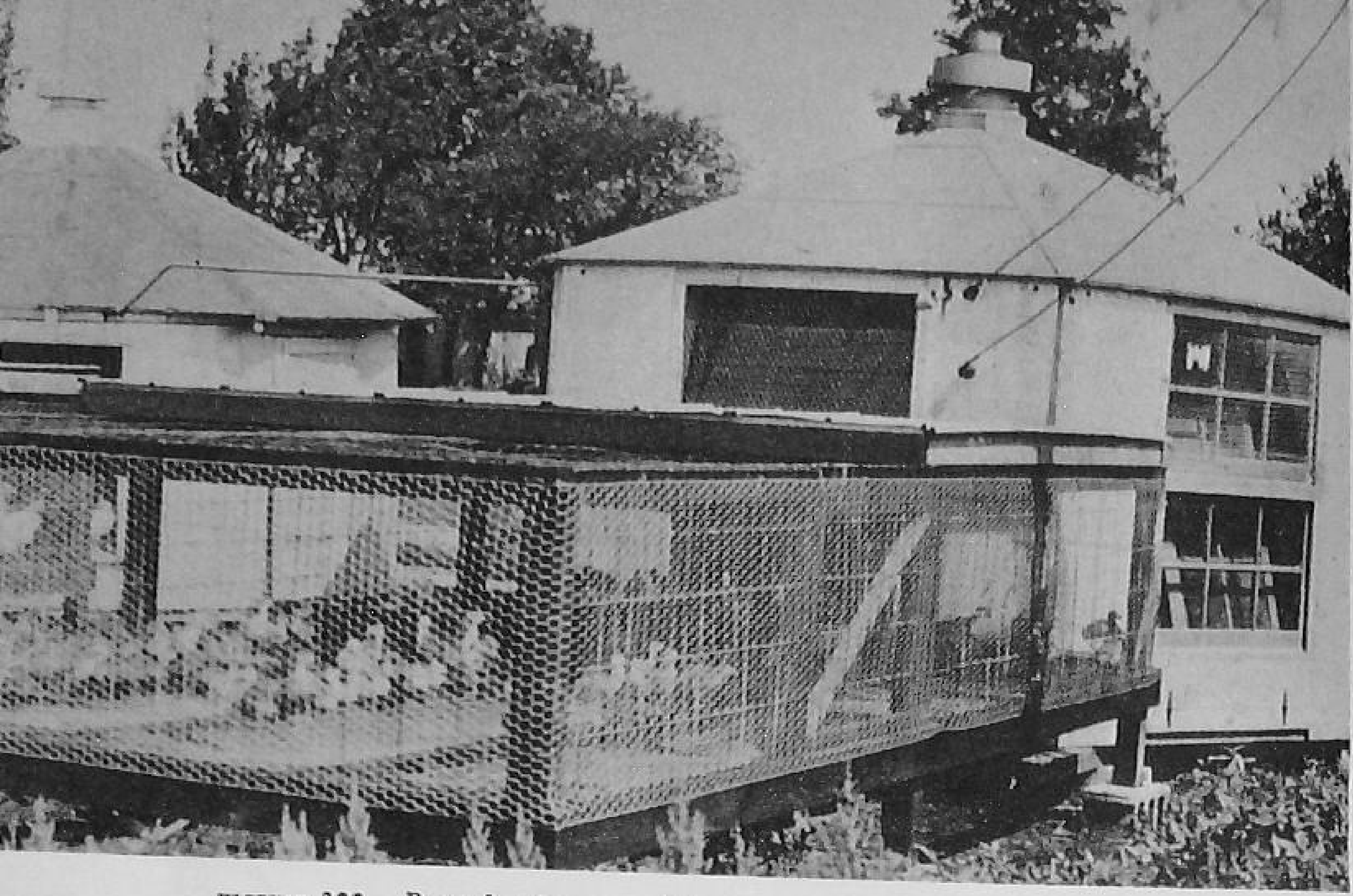


FIGURE 322. *Brooder house with sun porch. (Courtesy* Turkey World.)

Time to Start Poults. It takes from twenty-four to twenty-eight weeks to grow out a prime turkey. Poults should be started about six months before one plans to sell them, unless turkey broilers are being produced. Broilers may be marketed in twelve to fifteen weeks.

BROODING YOUNG POULTS

Brooder House. Thoroughly clean and disinfect the brooder house several weeks before it is to be used. Remove all litter and scrub it with lye water. Clean and disinfect all equipment.

Size of house. Houses 10 x 12 or 12 x 14 feet are recommended. About 1 square foot of floor space per poult should be allowed if the birds are to be moved to the range at eight weeks of age.

Windows. One or two windows on each side is sufficient. Too much window space makes it difficult to regulate heat.

Floor. A house with a wood floor, built on skids, is preferred.

Litter. Litter is very important in turkey production. A deep litter of 6 to 8 inches aids in keeping the quarters dry and sanitary. Litter should be coarse, because poults will eat fine litter. Crushed corncobs, peat moss, or cottonseed hulls may be used. Litter particles ¼ inch in diameter are preferred. Some growers use a fine wire mesh on the floor.

Brooder. The brooder should be set up and in operation a couple

FIGURE 323. *Turkey poults with a brooder guard. (Pease photo. Reprinted from* Successful Farming.)

of days before getting the poults. The grower should brood only 150 to 200 poults per hover.

Brooding Temperatures

First week	90°–95°
Second week	85°–90°
Third week	80°–85°
Fourth week	75°–80°
Fifth week	70°–75°
After fifth week	Maintain 70° until heat is no longer needed.

Brooder guard. A guard of wood, cardboard, metal, or wire should be placed completely around the hover to keep the poults from getting lost or chilled. Guard should be 3 to 4 feet from the hover.

Starting Poults. Poults should be placed under the hover as soon as possible after they have left the hatchery.

Feeding. Dip the beak of every third poult in water and feed to get them to start eating. Put in a few poults that are five or six days old to help teach young birds to eat. Spread oatmeal or finely ground, yellow corn on mash to help get poults eating. Keep a bright light over the feeders and waterers during the first week.

Each five poults needs 1 foot of feeder space for the first three

weeks. The feeder space should be increased gradually. At four weeks, a 4-foot feeder per twenty-five poults should be used.

Starter Ration. Farmers who grow turkeys in small numbers usually buy commercially mixed starter feeds. Large producers may mix their own. The following are suggested starter rations.

TABLE 54

STARTER MASH FORMULAS

Mash No. 1

	Pounds
Yellow cornmeal	20
Flour mids	15
Wheat bran	10
Ground oats	10
Oyster shell	1
Alfalfa leaf meal	5
Meat scraps	21
Soybean oilmeal	10
Dried milk	5
Salt	.5
Cod-liver oil	2
Manganese sulfate—¼ lb. per ton	
Penicillin—5 gm. per ton	

Mash No. 2
(Mo. Circular 625)

	Pounds
Yellow cornmeal	38
Wheat bran	5
Wheat shorts	10
Alfalfa leaf meal	5
Soybean oil meal	20
Meat scrap	10
Dried milk	10
Calcium carbonate	1
Salt	1
Fish oil (400D 2000A)	.5
Manganese sulfate—¼ lb. per ton	
Penicillin—5 gm. per ton	

Starter mashes should contain 24 to 28 per cent protein. Poults should have feed within thirty-six hours after hatching. Grit should be kept before the poults at all times.

Sun Porch. A sun porch about the same size as the house is needed to provide sunlight, exercise, and floor space as poults become older. The floor may be of 1 x 1-inch welded wire or of wood slats placed about 1 inch apart. Start using the sun porch the third week if weather permits.

Roosts. Poults will begin roosting at three to four weeks. Roosts from 3 to 4 inches wide should be provided at the back of the brooder house about 12 inches from the floor.

Waterers. Small quart jar waterers should be used the first few days, then a switch to larger ones should be made. A 3-gallon waterer will accommodate seventy-five poults. Healthy poults need plenty of fresh water.

Lights. The small lights over the feeders and waterers will assist in keeping the poults from piling up, as well as encouraging them to eat and drink.

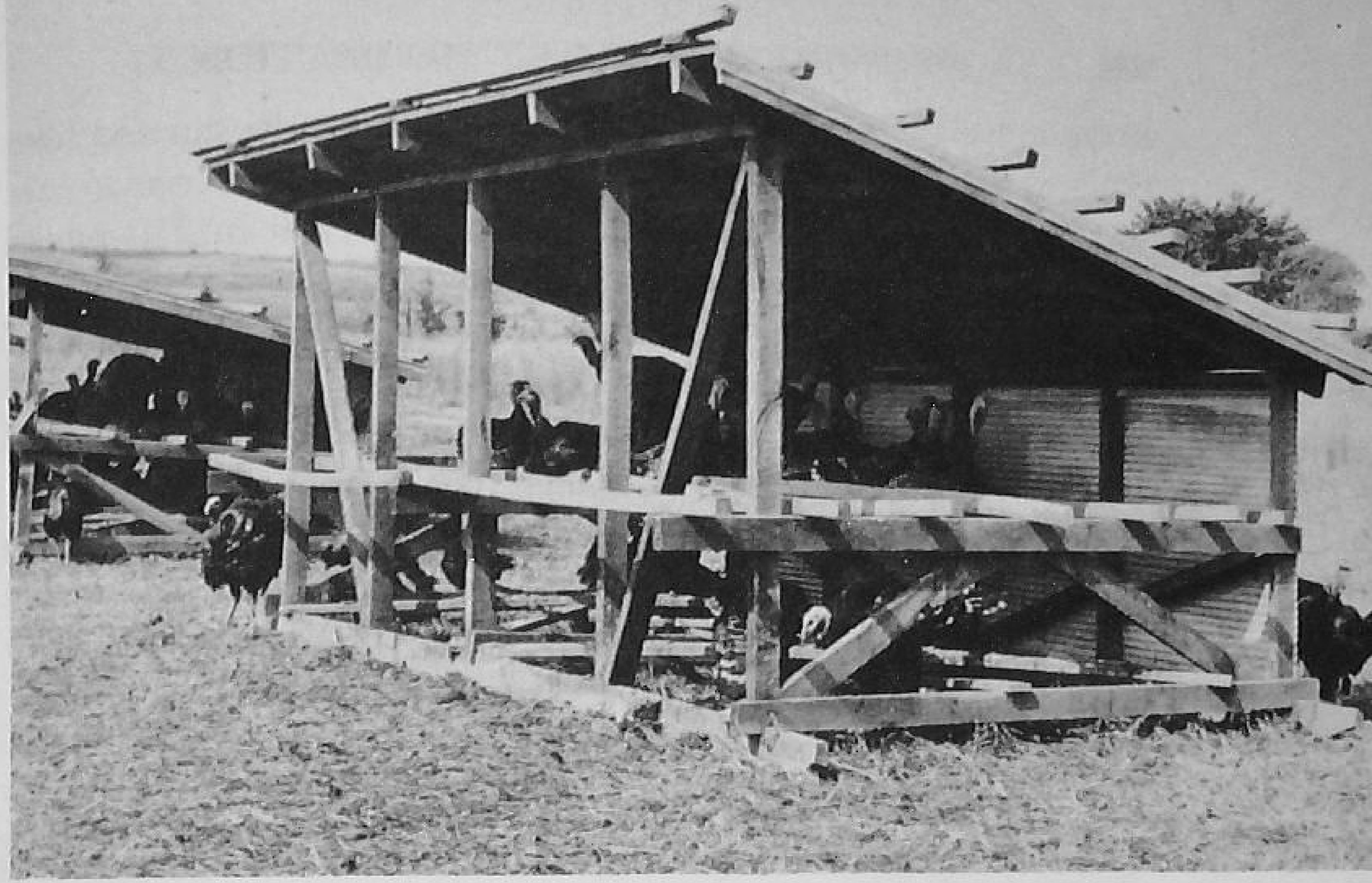


FIGURE 324. *A turkey range shelter.* (*Courtesy* Turkey World.)

RANGE MANAGEMENT

The grower ought to plan to move the poults to range when they are eight to twelve weeks of age. By that time the ration should have been gradually changed from a starter feed to a grower mash and grain.

Pastures for Turkeys. Turkeys on alfalfa in Kansas consumed 17 per cent less feed than turkeys raised in confinement. Green pasture furnishes vitamins, protein, and minerals which supplement the grower mash and grain.

Pasture crops. Alfalfa, lespedeza, ladino, and red clover make excellent pastures for poults. Sudan grass and fall seeded rye may also be used.

Rotate Pasture. Clean ground is a must in turkey production. Do not use any land for turkey range which had been used in growing either chickens or turkeys during the preceding three or four years. Blackhead disease may be spread by cecal worms which may live in the ground following chicken production.

Most poultrymen move their turkeys each week or ten days. Use the lower areas of the range first so the new range will not be contaminated later in the season; set up temporary fences, if necessary. In wet weather move poults more often.

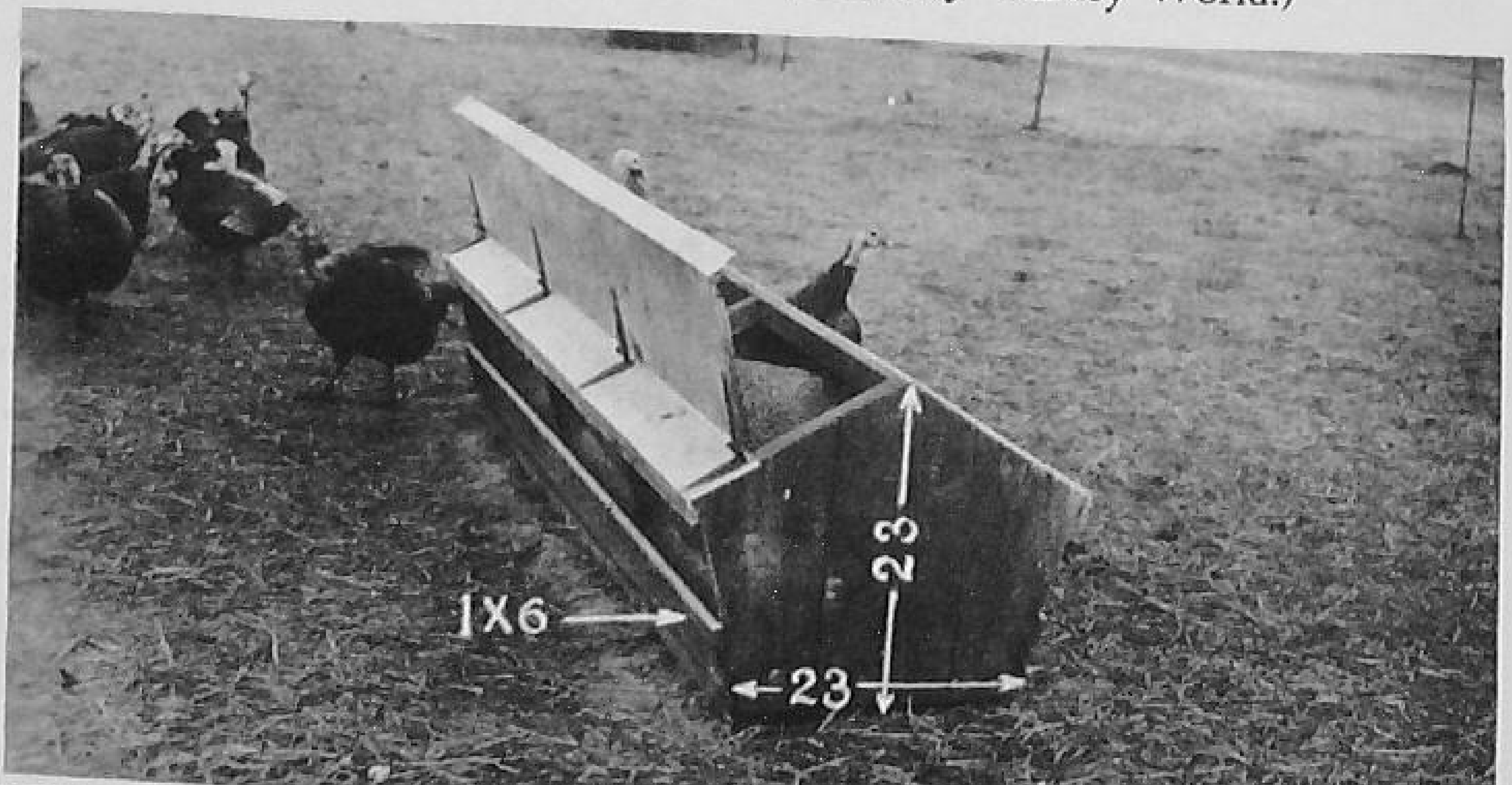
Range Shelters. Portable range shelters with roosts both over and under the roof may be used. Shelters made on skids are

easily moved. Birds need protection from both the sun and from the weather.

A 10 x 16-foot shelter will accommodate 200 to 250 poults. From 9 to 12 inches of roost space should be provided per bird. Roosts may be made of 2 x 4's or of poles, and should be placed about 3 feet off the ground.

Feeders. One foot of feeder space should be provided for each three birds. Many types of feeders may be made or purchased. The feeder should provide for continuous feeding without waste and provide protection of the feed in case of rain. Half of the feeders should be filled with grain and the other half filled with mash.

FIGURE 325. *Turkey feeders. (Courtesy* Turkey World.)



Growing Rations. *Grains.* Cracked corn or a mixture of corn, oats, wheat, and sorghums are good feeds to feed young turkeys on range. After birds can eat whole grain, it need not be ground. Oats help to feather the birds and may prevent feather picking.

Mineral and grit. Turkeys consume much fibrous material, so they need grit at all times. Granite grit should be provided. Minerals are usually fed as a part of the mash.

Mash feeds. Most commercial supplements for growing turkeys contain from 26 to 35 per cent protein. These concentrates permit the grower to feed large quantities of farm grains. The contents of any purchased supplement should be carefully checked. The cost per pound of protein should be calculated and its palatability checked. The best way to keep turkeys healthy is to keep them eating.

The following are suggested formulas for growing mashes.

TABLE 55

GROWING MASH FORMULAS

Mash No. 1 (USDA)

	Pounds
Meat scrap	20
Soybean oilmeal	20
Alfalfa leaf meal	15
Wheat mids	10
Fish meal	10
Wheat bran	7½
Ground yellow corn	7½
Steamed bone meal	6
Ground oyster shell or limestone	1½
Riboflavin concentrate	1
Salt	1½
	100

32% crude protein
4.9% calcium
2.3% phosphorus

Mash No. 2 (Minn. Extension Bulletin 124)

	Pounds
Meat scraps	175
Fish meal	210
Soybean oil meal	175
Dried milk	125
Alfalfa leaf meal	125
Bran	100
Bone meal	20
Ground limestone	30
Salt	25
Fortified cod-liver oil	15
	1000

38 per cent crude protein

Feeds Required Per Pound of Gain. Some turkey growers estimate that it will take from 90 to 100 pounds of feed to grow out a turkey to market weight. Feed required per pound of gain runs from 5 to 6 pounds. A turkey broiler can put on a pound of gain on 2½ to 2¾ pounds of feed.

The following table shows the feed required and rate of gain in growing out Broad Breasted Bronze turkeys on range.

FIGURE 326. *Turkey waterers.* (*Courtesy* Turkey World.)

TABLE 56

GROWTH AND FEED CONSUMPTION OF BROAD BREASTED BRONZE TURKEYS ON RANGE *

Age in Weeks	*Average Weight of Toms and Hens*	*Feed Required Per Pound Gain*	*Cumulative (pounds)*
1	.3	1.0	.1
4	1.2	1.9	1.6
8	3.4	2.3	6.7
12	6.7	2.9	15.4
16	10.3	3.8	28.0
20	14.1	4.7	43.8
24	17.3	6.7	62.9
28	20.1	9.0	86.4
Total or Average	20.1	4.3	86.4

* Mo. Circular 625, 1952.

Turkeys make much better use of feeds up to a weight of 12 to 16 pounds. The Beltsville Small Whites have become popular because they mature at lighter weights. They use less feed per pound of gain and produce a better weight of carcass for family consumption.

Antibiotics. Antibiotics will stimulate turkey growth as in chicken production. The greatest increases occur during the brooding stage, but 5 per cent increases in growth at twenty-four weeks of age have resulted from antibiotic feeding.

Aureomycin, bacitracin, penicillin, and terramycin have been fed with excellent results. The rate of feeding penicillin is from 2 to 4 grams per ton. The other antibiotics should be fed at the

FIGURE 327. *A debeaked turkey. (Courtesy* Turkey World.)

rate of 6 to 10 grams per ton. It is recommended that antibiotics be included in the mashes listed in Table 55.

Arsenicals. Arsenilic acid and 3-nitro-4-hydroxyphenyl arsenic acid produce increased growth when fed to turkeys in about the same amounts as antibiotics. Since they are toxic, they should be fed with care and according to the manufacturer's recommendations.

Water. Turkeys need plenty of clean, fresh water while on range. Waterers should be provided which will maintain a supply of water but will not permit the birds to contaminate it. It is better to place the waterer in the sun than in the shade.

Cannibalism. Feather-picking and cannibalism can be controlled in turkeys in the same manner as with chickens. Feeding oats in the ration, providing adequate range, and debeaking are the best methods.

FINISHING TURKEYS FOR MARKET

As long as a turkey is growing it is impossible to get it to put on a thick covering of flesh. Turkeys must be mature to be properly finished. Operations must be planned so that the poults are started in time to be finished for the desired market. The larger varieties will finish out weighing from 24 to 28 pounds.

The smaller varieties will finish weighing from 14 to 18 pounds.

Turkeys can be finished on grass and mash, but should receive a large amount of whole yellow corn in the ration. The birds should be examined before marketing them to see that the breast is broad and full. The back and hip bones should be well covered, and the skin should appear white due to the layer of fat underneath. The bird should have good feather growth. Pin feathers indicate immaturity and a general lack of condition.

TURKEY BROILER PRODUCTION

The production of turkey broilers has increased rapidly with the development of the Beltsville Small White Turkey. Turkey broilers are fed and managed in much the same manner as chicken broilers. They dress out with more breast meat and less leg meat than the chicken broiler, and there is less loss in the dressing process. Turkey broilers dress out at 5 to 7 pounds.

Day-old turkeys sell for 60 to 80 cents a pound while chicks sell for 10 to 18 cents. The selling price of turkey broilers must be high to show a profit. Turkey broilers are very efficient consumers of feed, but the original cost of the poults limits the profit from the enterprise.

There are three limiting factors in turkey broiler production: (1) the high price of the day-old poults, (2) the difficulty of getting a high finish on the young turkey, and (3) the discovery of a sufficiently high market for the birds to yield a profit.

SUMMARY

Turkey production is a highly specialized industry. Turkey growers buy poults from pullorum free flocks which have been bred for broad breasts and meat production. Broad Breasted Bronze, Standard Bronze, White Holland, and Beltsville Small White are the most popular varieties.

It takes about twelve to fifteen weeks to produce a turkey broiler and six to seven months to finish out a mature bird.

Turkeys are brooded in much the same manner as chicks, but not more than 150 to 200 poults should be brooded under one hover. Turkeys are more difficult to get started eating than chickens. A starter ration containing 24 to 28 per cent protein should be fed and fortified with penicillin or other antibiotics.

Provide deep coarse litter for the poults. Keep the brooder

house dry. Use a sun porch to increase floor space. Provide a foot of feeder space for each five poults the first three weeks. Double the feeder space after four weeks. Provide a 3-gallon waterer for each seventy-five poults.

Move the poults to a good legume range at eight to ten weeks. Use clean ground. Move feeders and shelters to new range each week or ten days. Good pasture may save 15 to 20 per cent of the feed. Provide 1 foot of feeder space for each three birds. Feed birds on range a 26 to 35 per cent protein mash and grains. Provide self-feeders. You should feed antibiotics even to market time, at the rate of 2 to 10 grams per ton.

It takes about 90 pounds of feed to grow out a turkey, or from 5 to 6 pounds of feed per pound of turkey. Turkey broilers will put on a pound of gain on less than 3 pounds of feed.

Sanitation, good rations, and careful management are essential in turkey production.

QUESTIONS

1. What is the place of turkey production on your farm?
2. Outline a plan for successful brooding of turkey poults.
3. Formulate a starting mash for turkeys.
4. What are the essentials of a good growing mash for turkeys on range?
5. Do chickens or turkeys make the most efficient use of feeds?
6. Outline a program of management of turkeys while on range.
7. Of what value is range to turkeys?
8. How can you tell when a turkey is ready for market?
9. What place do antibiotics and arsenicals have in turkey production?
10. What is the future of turkey broiler production?

REFERENCES

Billings, W. A., *Talking Turkey*, Extension Bulletin 124, University of Minnesota, 1947.

Charles, T. Burr, and Stuart, H. O., *Commercial Poultry Farming*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Weeks, John P., *The Poultry Profit Guide*, Vulcan Press, Birmingham, Alabama, 1953.

Winner, E. B., and McDougle, H. C., *Raising Turkeys*, Circular 625, University of Missouri, 1952.

Winter, A. R., and Funk, E. M., *Poultry Science and Practice*, J. B. Lippincott Company, Philadelphia, 1951.

< 34 >

Control of Diseases and Parasites

It has been estimated that of the 15 to 25 per cent of the chickens and turkeys produced (in this country) which die each year, 60 to 75 per cent die because of disease. The loss of chicks, poults, or hens quite often removes any possibility of having a profitable enterprise. Poultrymen need to be familiar with the causes and symptoms of the diseases and parasites most likely to cause trouble in order to plan programs of prevention and cure. Careful selection of chicks and laying stock, providing adequate housing, feeding satisfactory rations, and practicing sanitation in management will aid in avoiding disease and parasite losses, but disease outbreaks occur even when these practices are carried out.

DISEASES

The most serious diseases of chickens are pullorum, coccidiosis, bronchitis, range paralysis, laryngotracheitis, Newcastle disease, roup, fowl typhoid, fowl pox, blackhead, tuberculosis, and cholera. Many of these diseases affect turkeys and other fowl.

Pullorum. This is an acute, highly infectious bacterial disease which occurs between the second and third day after hatching and the time the chicks are about three weeks old.

Symptoms. Infected baby chicks or poults become weak and show a white diarrhea or "pasted-up-behind." Chicks which have been shipped or chilled are most susceptible to the disease. Losses may exceed from 30 to 40 per cent.

The disease occurs in the egg organs of infected hens and passes into the eggs. The chicks which are hatched from these eggs are infected. Most states have control programs under the National Poultry Improvement Program which encourage hatcheries to use only pullorum free flocks as sources of hatching eggs.

Prevention. The best preventative is to buy chicks from

FIGURE 328. *Chicks with pullorum disease. (Bailey photo. Reprinted from* Successful Farming.)

hatcheries cooperating in the State pullorum control programs. These programs require the blood testing of all birds used in hatchery flocks.

Treatment. Infected chicks should be given sulfamethazine or other sulfa drugs in water. The instructions of the manufacturer must be followed. Chicks must be kept warm and dry, and the quarters sanitary.

Coccidiosis. Coccidiosis is a protozoan disease which affects the intestinal tract of chicks, usually when they are from three to five weeks of age. Outbreaks occur most often during warm humid weather in early summer. Cecal coccidiosis is considered the most serious chick disease in this country. It is estmated that from 15 to 20 per cent of all chicks hatched in this nation die from this disease before they are a month old.

Symptoms. Chicks infected with the cecal type show bloody diarrhea, become listless, and have ruffled feathers. The birds eat little feed, and the comb and wattles become pale. Chicks with intestinal coccidiosis show the same symptoms as those with the cecal form, with the exception of having less blood in the droppings.

Prevention. The litter must be kept loose and dry. Feeding

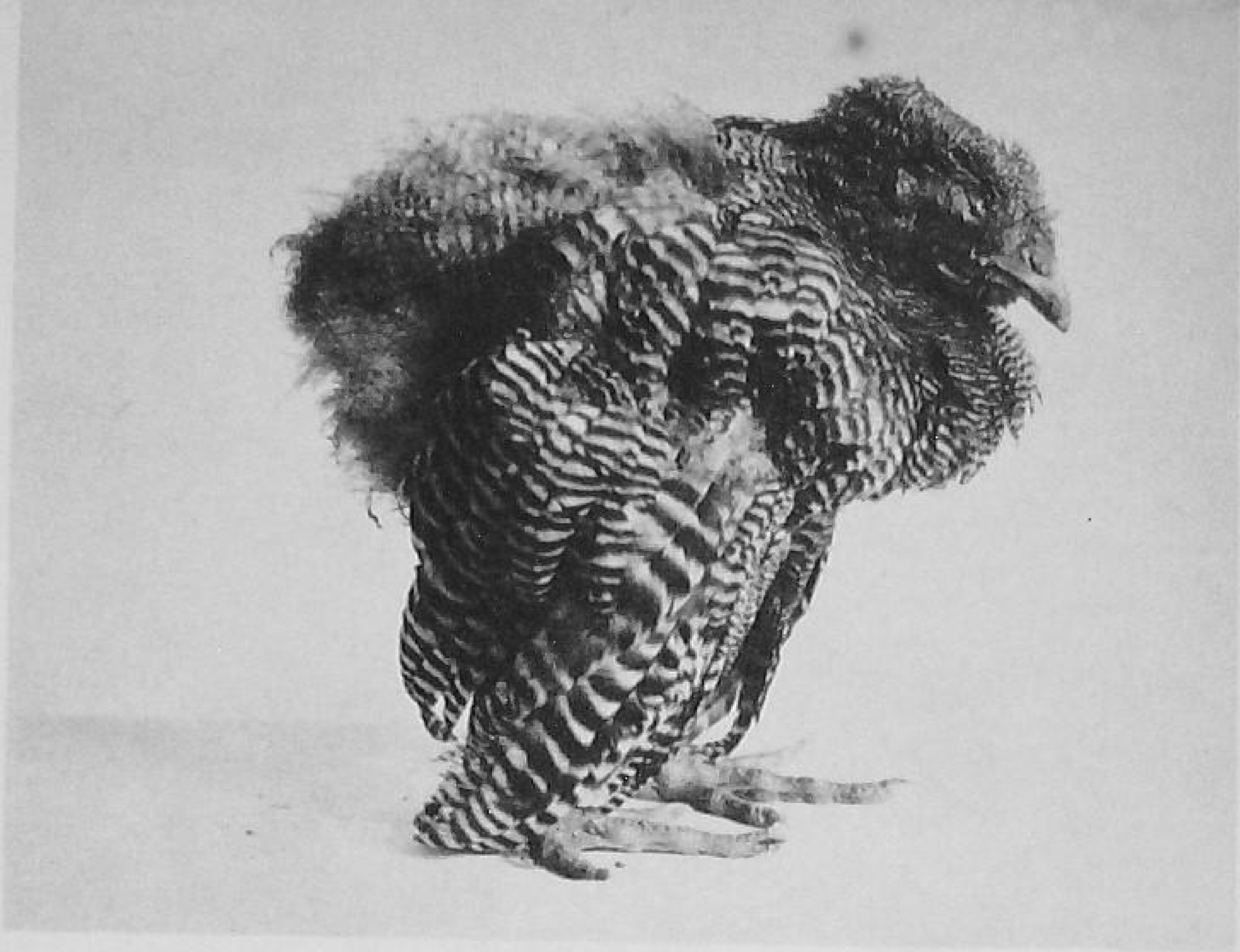


FIGURE 329. *A chick with coccidiosis.* (*Courtesy Kansas State College.*)

adequate rations containing antibiotics, aureomycin, and other antibiotics has proven to be helpful in preventing and treating coccidiosis outbreaks. Chicks develop an immunity for the disease if it is present at low levels.

Treatment. When coccidiosis strikes, it moves rapidly. The diseased birds or flock should be treated immediately with sulfa drugs according to the directions of the manufacturer or the veterinarian. Sulfaquinoxaline may be fed in mash at the rate of 4 ounces per ton as a control, or at the rate of 1 pound per ton of chick feed as a treatment. Sulfamethazine may also be used as a treatment.

Bronchitis. This respiratory disease may affect chickens at any age, but death loss is highest among chicks. Infected layers may be out of production for several weeks, but few birds die.

Symptoms. Infected birds have a raspy cough and gasp, and usually there is a discharge from the nose and eyes. The disease may spread through the entire flock in a day's time. Bronchitis resembles Newcastle disease, laryngotracheitis, and coryza.

Prevention. Sanitation in feeding and managing chicks and laying flocks is the best preventative. Isolating new birds brought on the farm is recommended. There is as yet no practical method of immunization.

Treatment. There is no cure. It is usually best to sell all birds which recover. Some commercial poultrymen bring infected

FIGURE 330. *Fowl laryngotracheitis. (Courtesy* Poultry Tribune.)

young chickens on to the farm when the chicks weigh from 1½ to 2 pounds. Partly grown chicks are not as seriously affected by the disease, and the young pullets will develop an immunity before they are placed in the laying house in the fall.

Laryngotracheitis. Fowl laryngotracheitis is a highly communicable and fatal virus disease. It attacks the larynx and windpipe and is most serious in pullets from five to ten months old. Birds which recover may be carriers and spread the infection to others.

Symptoms. The infection strikes rapidly. Dead birds may be found before symptoms are discovered. The chief symptoms are labored, gasping, and rattling breathing, with the bird's head extended and the beak open. Watery discharge from the eyes and nostrils may also be present. Birds may cough violently and expel bloody mucus, and they often die due to suffocation.

Prevention. Birds should be vaccinated when six weeks of age or shortly thereafter. The vaccine is applied in the vent with a brush. Immunity develops in six to nine days. All vaccinated birds should be checked after four or five days to see if the vaccination took effect. A reddening of the vent or a cheesy mucus indicates a "take."

Treatment. Vaccinate all birds. Rely upon a veterinarian.

FIGURE 331. *Newcastle disease. (Courtesy* Poultry Tribune.)

Feed a good ration, and practice sanitation. Burn immediately all dead birds.

Newcastle Disease. Newcastle disease has spread rapidly since about 1942 when it was discovered in California. It is a filterable virus which enters the bird through the respiratory tract. It affects both chickens and turkeys, and sometimes other species. It is highly infectious and causes death losses amounting to 25 to 80 per cent in both young chickens and in pullet flocks.

Symptoms. The usual symptoms are similar to those of bronchitis, tracheitis, and colds. Chicks sneeze, gasp, and have difficulty in breathing. They are weak and have ruffled feathers. Within a few days nervous symptoms begin. They may twitch their heads and necks, the head may become twisted and be drawn between the legs, or back over the shoulders. Birds may walk in circles or backwards.

Laying hens have breathing trouble, and they gasp, wheeze, and rattle. Although they do not have serious nervous symptoms, egg production drops to zero in a few days, and soft-shelled floor eggs are found.

Prevention. If Newcastle disease has not been present on the farm or in the community, practice sanitation in production and management. Isolate all new birds. Keep visitors out of the poultry houses and yards.

On farms where Newcastle is known to exist, all chicks, after they are four weeks old, should be vaccinated with Newcastle disease vaccine. Birds are inoculated through the web of the wing. All susceptible birds should be vaccinated at the same time to avoid

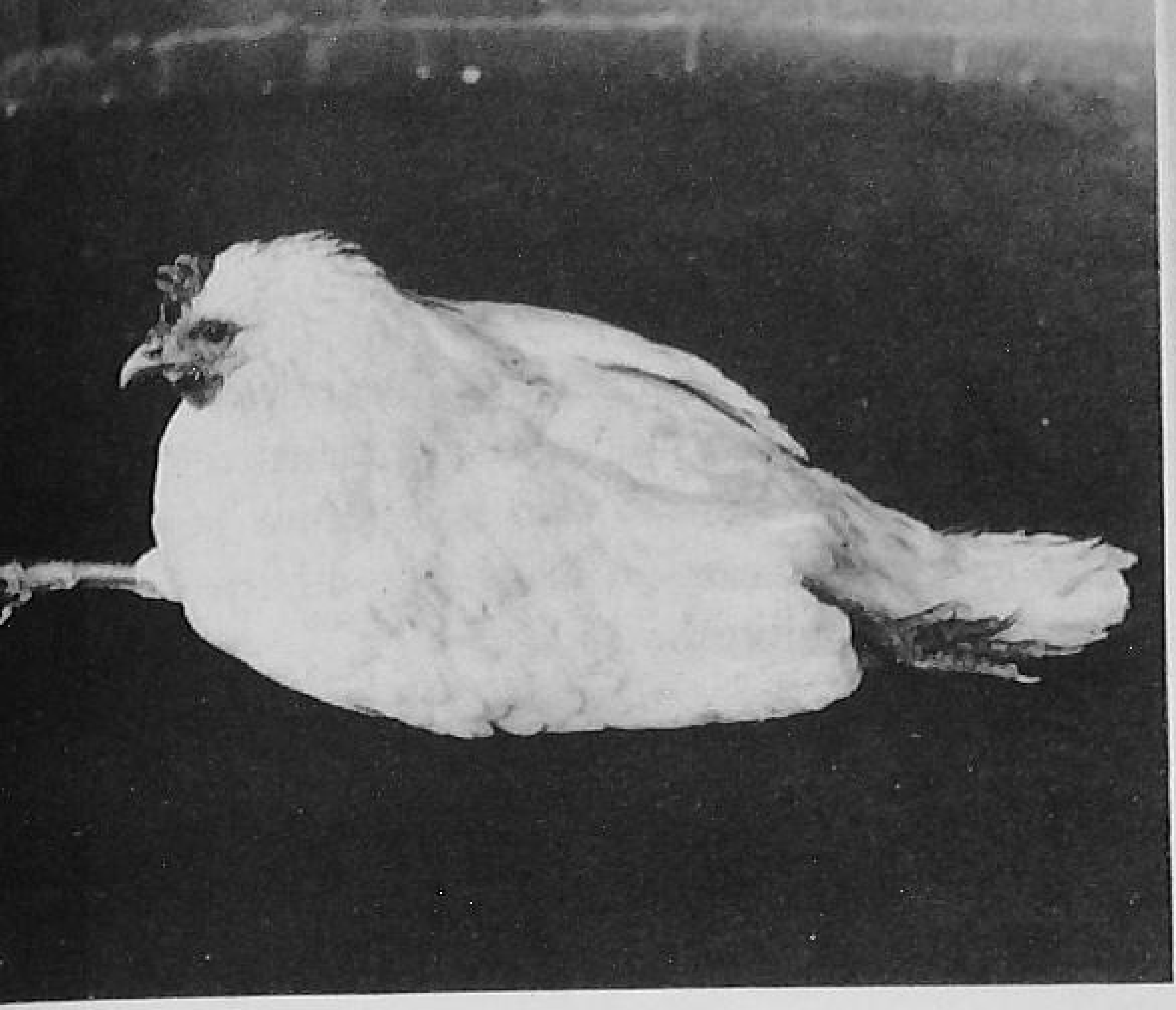


FIGURE 332. *(left) Leg paralysis due to leucosis. (right) Gray eyes due to leucosis. (Courtesy* Broiler Growing.)

danger of unvaccinated birds becoming infected. Only healthy birds can be vaccinated, because serious losses may occur if unhealthy birds are vaccinated. Pullets should be vaccinated at least one month before they start to lay.

Treatment. There is no cure. Palatable rations should be fed, and desirable housing quarters maintained.

Range Paralysis. Fowl paralysis or avin leucosis complex is caused by a virus which affects chickens and turkeys, but some strains are more resistant to it than others.

Symptoms. Young birds are more susceptible to the disease than old birds, and symptoms begin to show up when they are about six weeks old. It takes about seven weeks for the disease to develop after the chick has become infected. Heavy losses occur between four and eight months.

Infected birds show partial or complete paralysis of one or both legs or wings. Birds quite often show gray eyes. The iris loses its normal color and becomes distorted. The liver and spleen may become enlarged, and visceral involvement may be seen.

Prevention. There is no treatment or cure for the disease. Buying chicks from hatchery flocks known to be free from the disease will help. Fortified, balanced rations should be fed, and the chicks should be grown on a clean range away from all other chicks.

Fowl Pox. Chicken pox or sore-head is caused by a virus. It is quite infectious and shows up in two different forms. One form affects the skin and comb, the other affects the throat.

Symptoms. Small blister-like spots appear on the face, comb, and wattles. Light infection results in a few scattered spots. Heavy infection may cover the face, comb, and wattles. The diphtheritic form affects the mouth and throat, and yellow pus-like patches appear. The eyes may water, the birds will lose their appetites, and production will diminish.

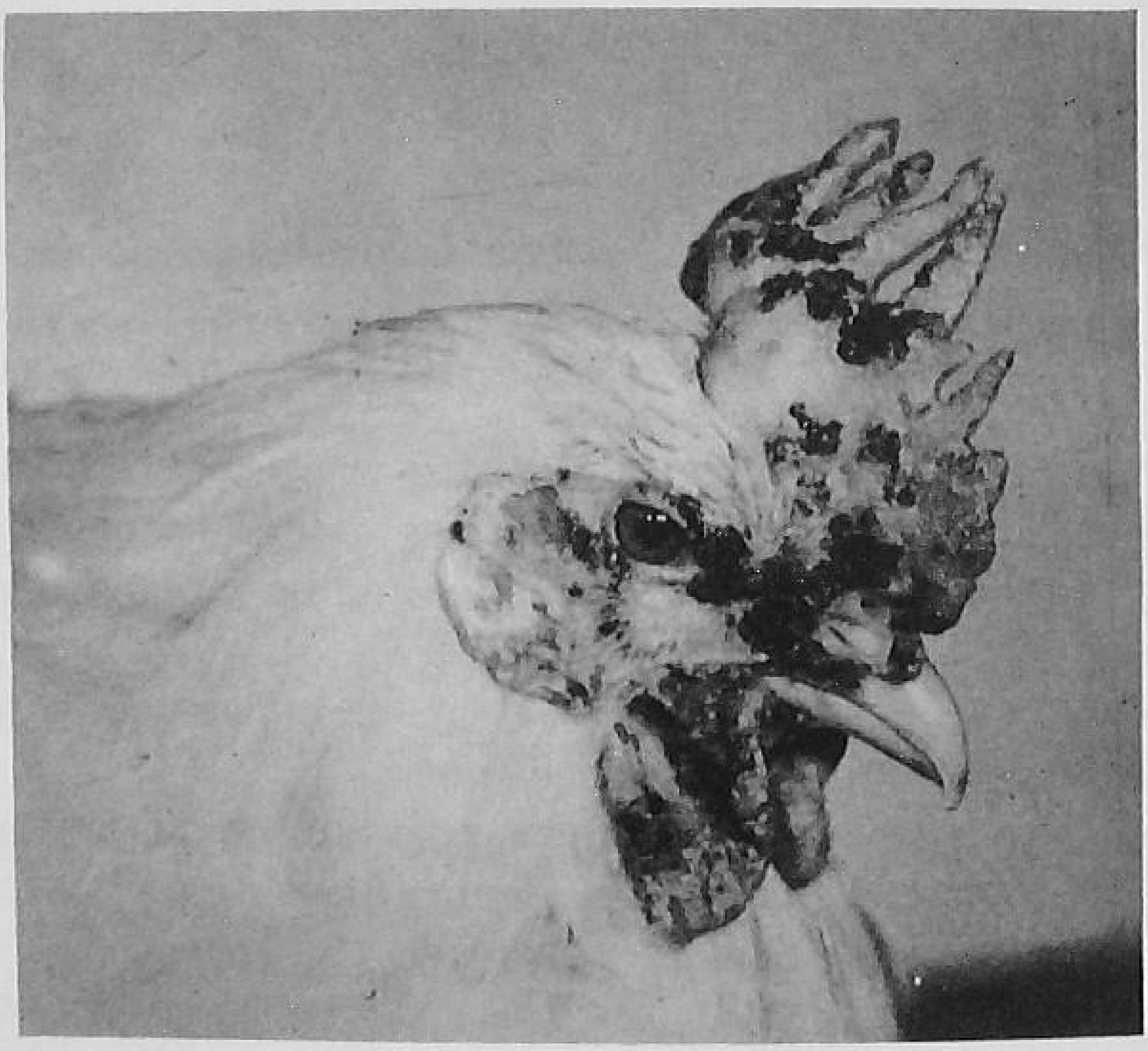


FIGURE 333. *Fowl pox. (Courtesy* Poultry Tribune.)

Prevention. Almost complete protection will result from the vaccination of chickens while they are from six to sixteen weeks of age. Veterinarians use the stick method. If the disease has been present on the farm, vaccination each year is recommended.

Treatment. No successful treatment is available.

Roup. This infection is also known as coryza or cold. It is an infectious inflammation of the sinuses and upper respiratory tract and is caused by a bacteria. Death losses are low, but financial losses result from decreased growth and production of diseased birds.

Symptoms. A thin, watery discharge from the nostrils during

the early stages of infection changes to a thick, sticky discharge which has an offensive aroma. Roup is usually detected by this aroma. Yellow masses of mucus form around the nostrils and eyes, and the birds may cough and sneeze.

Prevention. The isolation of birds brought on to the farm and the use of sanitation in feeding and management are the best preventative methods.

Treatment. Sulfa drugs are effective in controlling roup. One-half pound of sulfathiazine to each 100 pounds of mash is recommended, or sulfamethazine may be fed in water. The directions of the manufacturer must be followed.

Typhoid. Fowl typhoid is a bacterial disease which affects both chickens and turkeys. Losses average about 25 per cent, but 80 per cent losses have been reported. The disease occurs mostly in mature birds.

Symptoms. Birds with typhoid are droopy, have little appetite, and crave water. The livers are infected, and birds show a profuse, watery, green diarrhea. Chickens may suffer from a few days to about two weeks. Turkeys die within two or three days.

Prevention. All birds in the laying or breeding flock should be blood tested and carriers eliminated. Birds may be vaccinated for typhoid with avisepticus-gallinarum bacterin. It is a job for a veterinarian, or a poultry specialist.

Treatment. Sulfa-drug treatments with or without repeated injections of bacterins will aid in controlling the disease. Sodium sulfamerazine fed in the drinking water is recommended. The directions of the manufacturer or veterinarian must be followed.

Fowl Cholera. This disease affects all species of poultry and causes heavy losses. It is very contagious and spreads rapidly, and birds begin to die sometimes before the disease has been discovered. It is caused by a bacteria.

Symptoms. Birds which appear healthy die suddenly. Infected birds are weak, droopy, and inactive. They have ruffled feathers, a loss of appetite, and a fever. The heads, combs, and wattles become dark colored, and a greenish or yellowish diarrhea is evidenced. Birds rarely recover.

Prevention. All healthy birds should be vaccinated if the disease is prevalent in the community or on the farm. The vaccine is a dual-purpose bacterin which controls both typhoid and cholera. Chickens and poults from six to twelve weeks old should be given

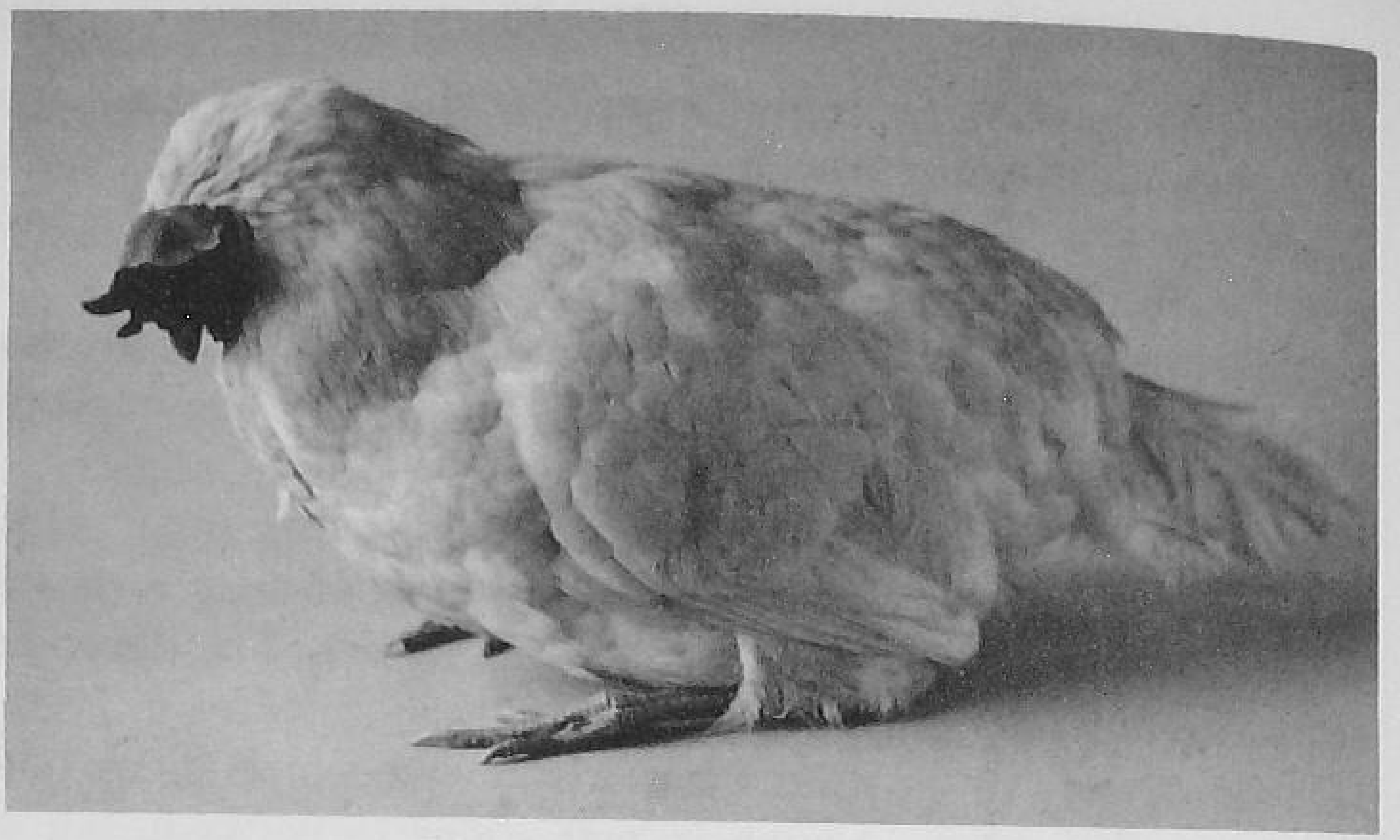


FIGURE 334. *Fowl cholera.* (*Courtesy* Poultry Tribune.)

½ c.c. of avisepticus-gallinarum bacterin; chickens over twelve weeks old and turkeys weighing less than 10 pounds are given 1 c.c., and turkeys over 10 pounds, 2 c.c.

Treatment. Sulfamethazine in the drinking water will aid in checking death loss, and sanitation is an absolute necessity in controlling cholera. Cleaning and disinfecting houses and equipment, removing and burning dead birds should be carried out.

Tuberculosis. Tuberculosis is caused by mycobacterin tuberculosis avium. It is infectious and occurs in many types of poultry.

Symptoms. The disease rarely affects young birds because it takes many months for the disease to take effect. Birds over eighteen months of age are more likely to be affected than young birds. Infected birds lose weight, are inactive, and quit laying. The combs and wattles shrink and become dry and pale in color. The birds finally die.

Prevention. There is no treatment for tuberculosis, and the best control method is to sell off all hens at the end of the first laying season. Pullets which have been raised under sanitary conditions, and are housed in a well-disinfected house, rarely show signs of the disease during the first laying season. Adequate, well-balanced rations also help prevent losses due to tuberculosis.

If old hens are kept over they should be blood tested. Injections may be made in the wattles, or the antigen blood test may be made. Only birds which are free from the disease should be kept.

Since the infection can spread from chickens to hogs it is necessary that all diseased or dead birds be kept away from the hogs.

Blackhead. This is one of the very infectious protozoan diseases, and it affects chickens, turkeys, and other fowl. It is highly fatal in turkeys.

Symptoms. The common symptoms of the disease in turkeys are lowered head, drooping wings, ruffled feathers, drowsiness, and a yellowish diarrhea. Young turkeys may die without showing signs of the infection.

The disease is mild in chickens but spreads from chickens to turkeys. Most outbreaks in turkey flocks are traceable to chickens. The disease lives over in the cecal worms or worm eggs of the chickens.

Prevention. Grow poults and chicks on clean ground and in separate quarters. Use sun porches with wire mesh floors if impossible to get birds on clean range. Worm flocks with phenothiazine at the rate of 1 pound per 100 pounds of mash for each 1000 birds. Keep turkeys away from chickens and chicken ranges.

Treatment. When an outbreak occurs, healthy turkeys should be removed to a clean range, and the birds treated with phenothiazine mash to remove cecal worms. Enheptin and othei materials are available from veterinarians which are helpful in treating infected birds. The successful use of medication depends upon how soon treatment follows the first signs of infection.

Infectious Sinusitis. This disease affects turkeys, and although it is not acute, large numbers of birds may be affected.

FIGURE 335. *Infectious sinusitis. (Courtesy Kansas State College.)*

Symptoms. One or both sides of the face become swollen. The eyes may become closed, and the birds have difficulty in breathing.

Treatment. Remove the fluid from the swollen sinuses by the use of a sterile syringe and a 1½-inch, 18- or 19-gauge needle. Inject 4 c.c. of 1 per cent silver nitrate solution into the sinus. Do not put the bird with the flock.

Air Sac Infection. Air sac infection affects mature turkeys, but few birds die. It appears to be a virus infection.

Symptoms. Birds gasp for breath, and there is often a mucus discharge from the trachea. Some birds suffocate if forced to exercise.

Treatment and control. There is no known treatment. Daily culling and isolation of birds will help prevent further contagion. Sanitation should be practiced, and the house and equipment should be disinfected.

PARASITES

Large roundworms and cecal worms are the most serious internal parasites of poultry. Lice and mites are the serious external parasites.

Large Roundworms. These worms live in the small intestines, and the eggs are passed with the droppings. These eggs, which mature in about two months, are picked up by other chickens.

Symptoms. When heavily infested, young chickens become unthrifty and stunted. Some may die. Mature birds are droopy, and they have pale combs and wattles and ruffled feathers. Their appetite is poor, and they quit laying. The large worms live on food which has already been digested, thus using food needed by the bird in growth and egg production.

Prevention. Sanitation and rotated ranges are the best preventatives. Thorough cleaning and disinfecting of the houses and equipment is a must. Good litter, well managed, and the use of dropping pits are good aids. Young pullets ought to be grown on a clean range.

Treatment. One ounce of phenothiazine in one feeding for 60 medium weight mature birds, or 1 ounce per 100 3-pound young chickens is recommended. Nicotine-bentonite compounds are also available and very effective. The directions of the manufacturer must be observed.

Cecal Worms. These worms are usually about ½ inch long and

grayish-white in color. They live in the ceca or blind pouches. The eggs are expelled with droppings, and the life cycle of the parasite is similar to that of the roundworm. To get rid of the worm is important because it serves as a host for blackhead disease.

Symptoms. The worms cause inflammation of the ceca but there are usually no outward symptoms.

Prevention. These worms are prevented in the same manner as roundworms. Sanitation practices and rotated ranges are necessary. Chickens and turkeys should be kept on separate clean ranges.

Treatment. Phenothiazine may be fed in the mash at the rate of 1 pound to 100 pounds of mash for 1000 birds. The dose per individual chicken is ½ gram. A compound containing 15 grams of 40 per cent nicotine sulfate, 151 grams of phenolthiazine, 287 grams of bentonite, and 44 pounds of chicken mash has produced excellent results.

Lice. Head, body, and shaft lice infest poultry and cause loss in growth and egg production. These insects feed on feathers and skin.

Symptoms. Birds are unthrifty, feathers may be ruffled, and production decreases.

Treatment. Dust birds with sodium fluoride, and spread 2 pounds of agricultural sulphur on the litter on each 100 square feet of floor space in the house. Apply lindane in nests and on litter and roosts.

Mites. Chicken mites live on the roosts or on other parts of the house during the day and attack the birds at night. They are blood-sucking insects.

Symptoms. Birds may appear droopy or listless. Masses of mites may be found during the day on roosts and in cracks.

Treatment. Roosts, nests, boards, and lower part of hen house should be sprayed with an insecticide, creosote oil, or carbolineum mixed with kerosene. Scaly leg mite can be controlled by dipping the shanks in kerosene.

SUMMARY

Pullorum in chicks can be controlled by buying chicks from hatcheries cooperating in the National Poultry Improvement Program. Coccidiosis is our most serious chick disease. It can be prevented by buying early chicks, keeping litter dry, and by feeding antibiotics. Sulfaquinoxaline and sulfamethazine are the best.

A veterinarian should be called when an outbreak of the respiratory diseases takes place. There is no cure for typhoid. Birds may be vaccinated for laryngotracheitis when they are six weeks of age or older. On farms where Newcastle has not been present, sanitary methods should be used, and new birds must be isolated. Where Newcastle is known to exist, all birds should be vaccinated on the farm when they are four weeks of age or older.

Buy chicks from strains known to be free from range paralysis, because there is no cure. You can tell roup by the aroma. Use sulfa drugs and good management as controls.

For typhoid give the birds blood tests. Vaccinate birds for typhoid and cholera, and burn dead birds. Practice sanitation, and feed sulfa drugs as controls.

Tuberculosis affects older birds. Pullets should be grown on clean ground, and all old hens should be sold off after one year's production. Any old birds held over should be given blood tests. Clean and disinfect the house and premises.

Blackhead is best controlled by using clean range and by getting rid of cecal worms. Enheptin and other medicines are available, and should be fed according to directions. Infected birds should be kept moving to new range.

Worm chickens with phenothiazine or nicotine-bentonite compounds. Follow directions. Use sodium fluoride or dusting sulphur to control lice, and spray quarters with creosote oil or carbolineum and kerosene to control mites.

QUESTIONS

1. What practical method do you have for control of pullorum on your farm?
2. What methods would you use to control an outbreak of coccidiosis on your farm?
3. How can you tell the difference between Newcastle disease, bronchitis, roup, and laryngotracheitis? How would you treat these diseases?
4. Which of the diseases of poultry are transmitted through the egg from the hen to the chick?
5. How can you control range paralysis?
6. What are the means of controlling cholera and typhoid?
7. Under what conditions should heavy producing hens be kept over a second year? Explain.

8. Is there a relationship between blackhead in chickens and blackhead in turkeys?
9. Trace the life history of a cecal worm.
10. Which materials are effective in worming chickens?
11. Plan a disease and parasite control program for your farm.

REFERENCES

Brunett, E. L., *Fowl Pox*, Bulletin 337 C, Cornell University, 1947.

———, *Pullorum Disease*, Bulletin 337 A, Cornell University, 1948.

Dykstra, R. R., *Animal Sanitation and Disease Control*, The Interstate Printers and Publishers, Danville, Illinois, 1949.

Koutz, F. R., *Coccidiosis in Chickens*, Extension Bulletin 320, Ohio State University, 1951.

Moore, E. N., *Blackhead Can Be Controlled*, Extension Bulletin 806, Cornell University, 1950.

Sherrill, William, *Controlling Newcastle Disease*, Subject Matter Bulletin No. 18, Texas A. & M. College.

Stamm, G. W., *Veterinary Guide for Farmers*, Windsor Press, New York, 1950.

Weeks, John P., *The Poultry Profit Guide*, Vulcan Press, Birmingham, Alabama, 1952.

< 35 >

Marketing Poultry Products

Poultrymen are confronted with three major problems in marketing their products: (1) how to plan production to be able to market the products at the peak seasonal price; (2) how to produce the quality of products desired by the processor and consumer; and (3) how to locate the best market.

The large scale producer analyzes his marketing program very carefully, for his livelihood depends upon the profit from the enterprise. The small producers are quite often careless in marketing their products, and most of our poultrymen are small producers. The poultry enterprise is a minor enterprise in most states. Less than 8 per cent of the total cash livestock income in thirty-seven states in 1951 resulted from the sale of chickens, and in thirty-four states less than 8 per cent of the livestock income was received from the sale of eggs. In most of these states considerable increases in poultry income would result from the use of improved marketing methods.

MARKETING OF EGGS

It has been estimated that egg income per hen can be increased from 50 cents to $1.00 per year by having maximum production during the periods of high prices, by producing high quality eggs, and by careful selection of markets.

Seasonal Price Trends. Egg prices fluctuate during the year in much the same manner as hog prices.

Egg production trends. Production has been high during March, April, May, and June. The price of eggs during those months is low. Egg production during September, October, November, and December is comparatively low, and prices are high. With improved methods of production, flock owners are now producing a higher percentage of the eggs during the months when prices are

high than was done fifteen or twenty years ago. Figure 336 shows the trends in seasonal egg production since 1935.

Price trends. During the 1934–1946 period "extra" quality eggs sold in Chicago for an average of 34 cents in November and for 22 cents in March. The spread in seasonal prices for the other grades was nearly as wide. One of the keys to egg profits is to

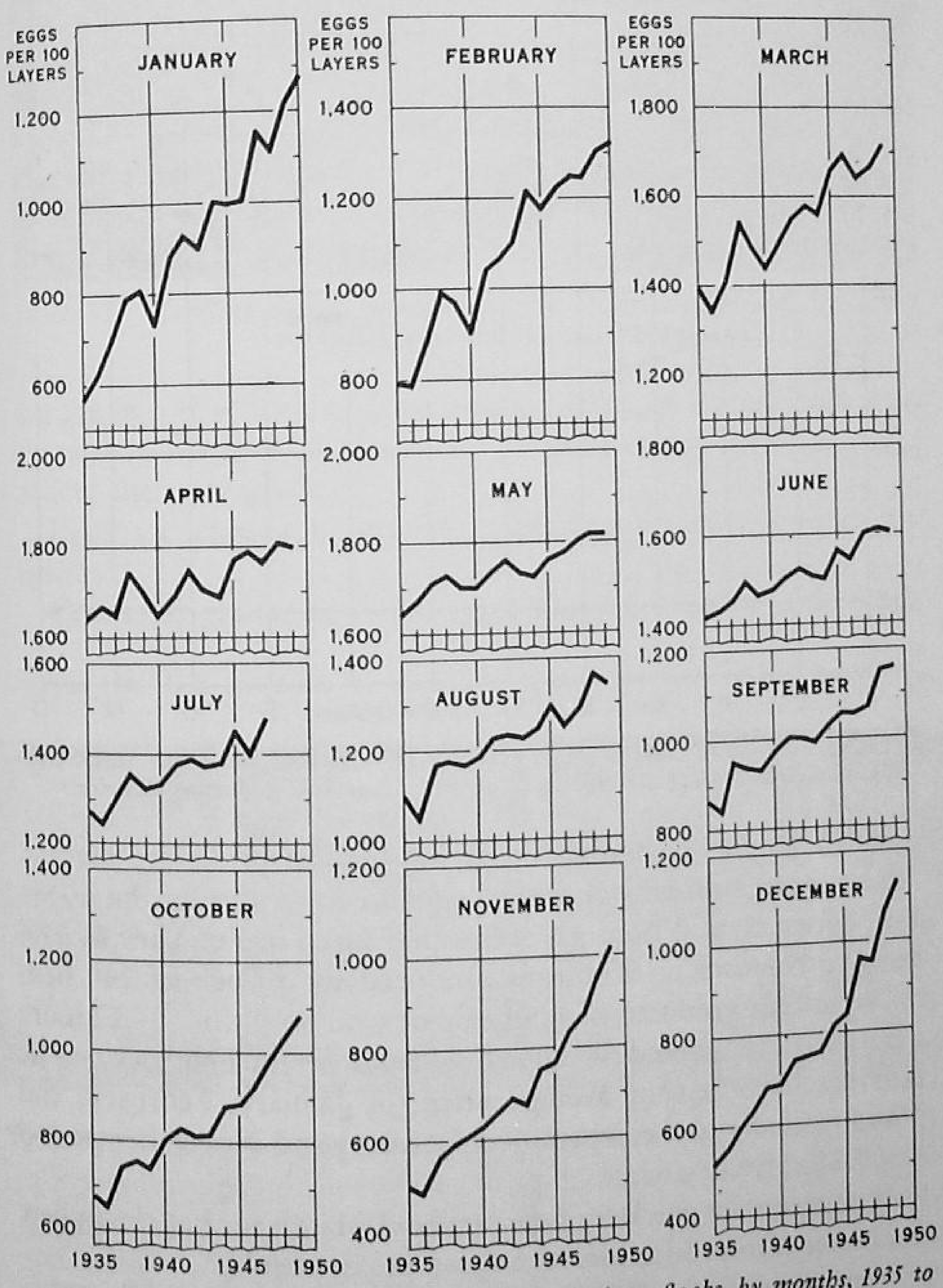


FIGURE 336. *Rates of lay: Eggs per 100 layers in farm flocks, by months, 1935 to date. (Courtesy U.S.D.A. Bureau of Agricultural Economics.)*

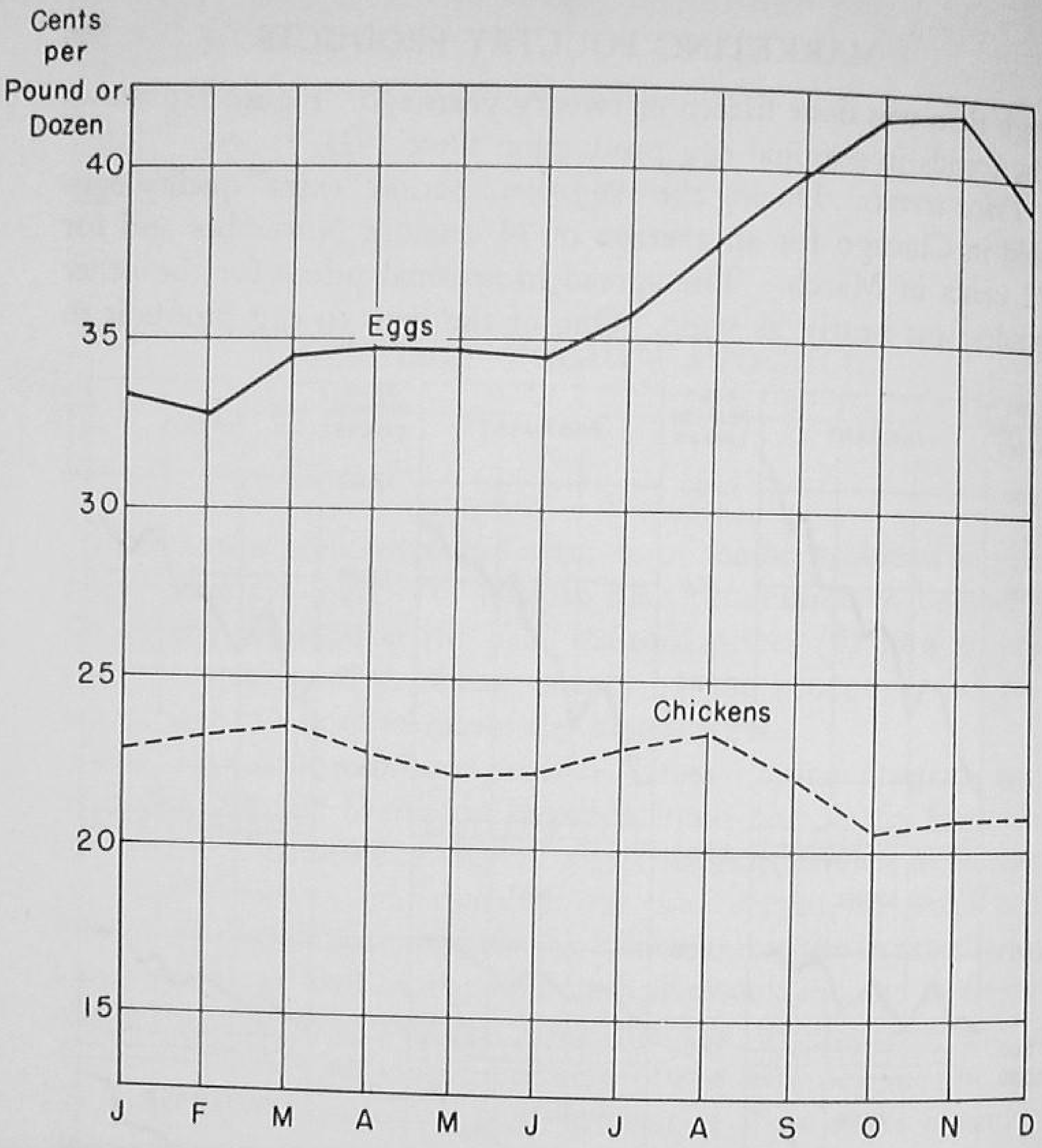


FIGURE 337. *Monthly average prices received for chicken and eggs. (Iowa five-year period, 1948–1952.) (Iowa Crop and Livestock Reporting Service.)*

get high production during the months when prices are highest.

The average monthly price of eggs in Iowa during the 1948–1952 period ranged from 32.5 cents per dozen in February to 41.6 cents in November. The eggs produced by a flock of 240 hens at 70 per cent production in November would sell for $38.22 more than the same number of eggs would sell for in February. The difference between the average price for January, February, and March period and the September, October, and November period was 7.7 cents per dozen.

It pays to start chicks in February and March so that the pullets will come into production in August and September.

Classes and Grades of Eggs. Care in the production and handling of eggs may net from 2 to 6 cents more per dozen if they are sold

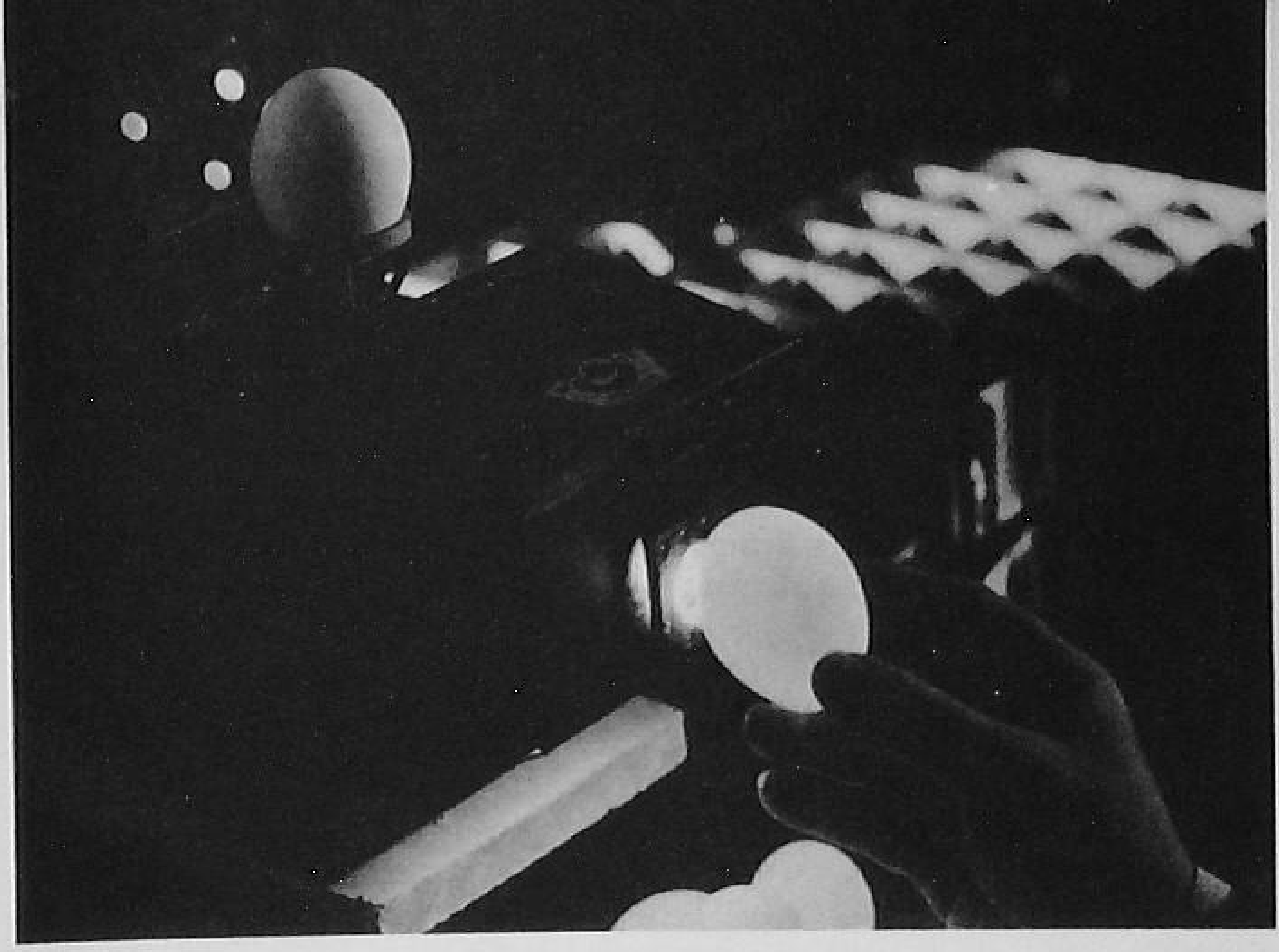


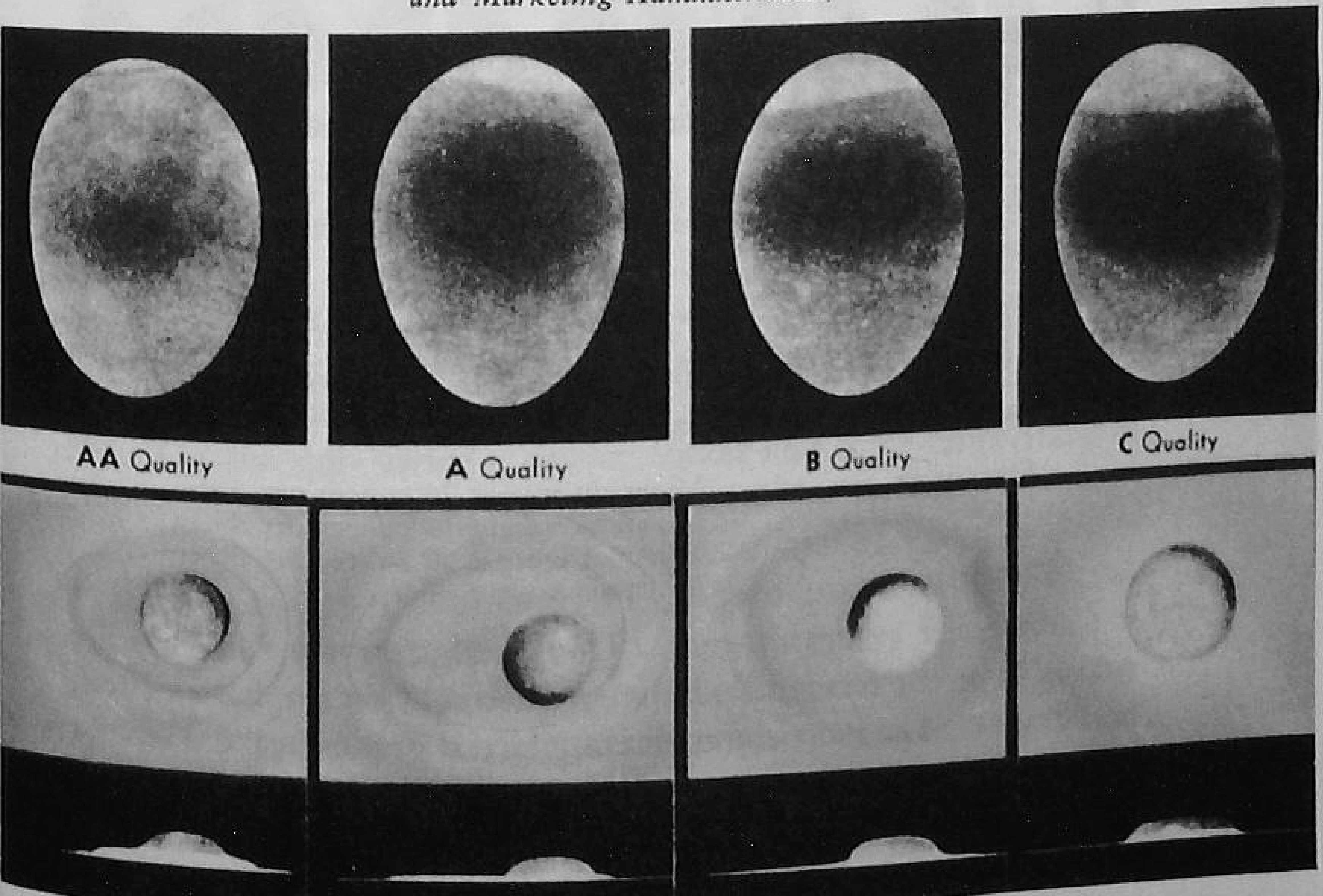
FIGURE 338. *Candling eggs to determine quality. (Courtesy Brownell Farms, Milwaukie, Oregon, and* Hatchery Tribune.)

by grade. If a flock of hens average 180 eggs a year, from 30 to 90 cents a hen can be cleared by properly caring for the eggs and selling them by grade.

Eggs are classed in grading according to color, weight, and quality.

Consumer grades of shell eggs. The main factors in determin-

FIGURE 339. *U.S. standards for quality of eggs. (Courtesy U.S.D.A. Production and Marketing Administration.)*



ing the quality of an egg are the albumen quality, the freedom from defects, and shell quality. Commercially, egg quality is determined by candling. The four United States consumer grades of eggs are shown in Figure 339. The characteristics of these grades are as follows:

A A Quality–Clean, unbroken, practically normal shell. Practically regular air cell ⅛ inch or less in depth. Clear, firm, white. Yolk well centered; outline defined; free from defects.

A Quality–Clean, unbroken, practically normal shell. Practically regular air cell ¼ inch or less in depth. Clean, reasonably firm, white. Yolk fairly well centered; outline fairly well defined; practically no defects.

B Quality–Clean, unbroken shell but may be slightly abnormal. Air cell ⅜ inch or less in depth. May show movement not over ⅜ inch if not over ¼ inch; may be free. Clear, slightly weak, white. Yolk may be off center. Outline well defined; may be slightly enlarged or flattened; may show definite but not serious defects.

C Quality–Clean, unbroken shell; may be abnormal. Air cell may be over ⅜ inch in depth; may be free or bubbly. Clear, white; may be weak and watery; small blood clots or spots may be present. Yolk may be enlarged, off center, and flattened; may show visible germ development but no blood; may show other serious defects; outline plainly visible.

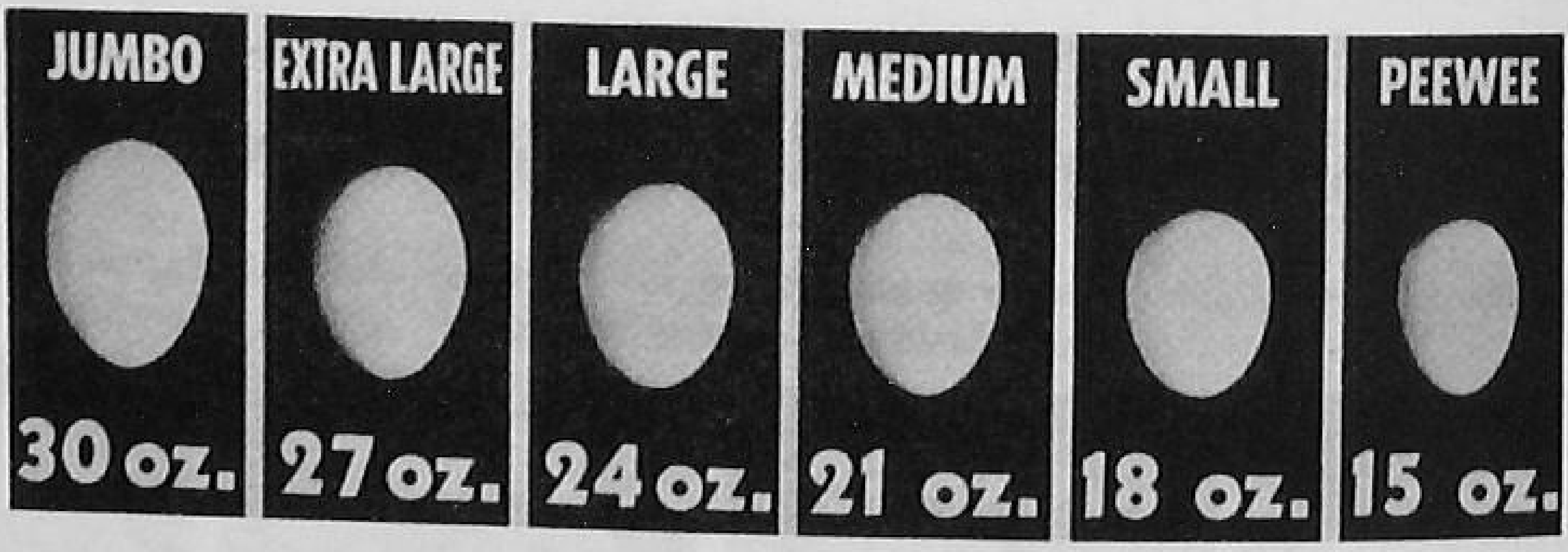


FIGURE 340. *U.S. weight classes of eggs (minimum weight per dozen). (Courtesy U.S.D.A. Production and Marketing Administration.)*

Weight classes of eggs. The United States consumer weight classes of eggs are shown in Figure 340. Wholesale eggs are graded according to weight as follows:

Extra large	Minimum weight 26 ounces per dozen
Large	Minimum weight 23 ounces per dozen
Medium	Minimum weight 20 ounces per dozen
Small	Minimum weight none

Commercial grades of eggs. Ungraded, country-run eggs are sold as "current receipts." Few eggs are sold on the basis of federal grades. The most common commercial grades in the Midwest

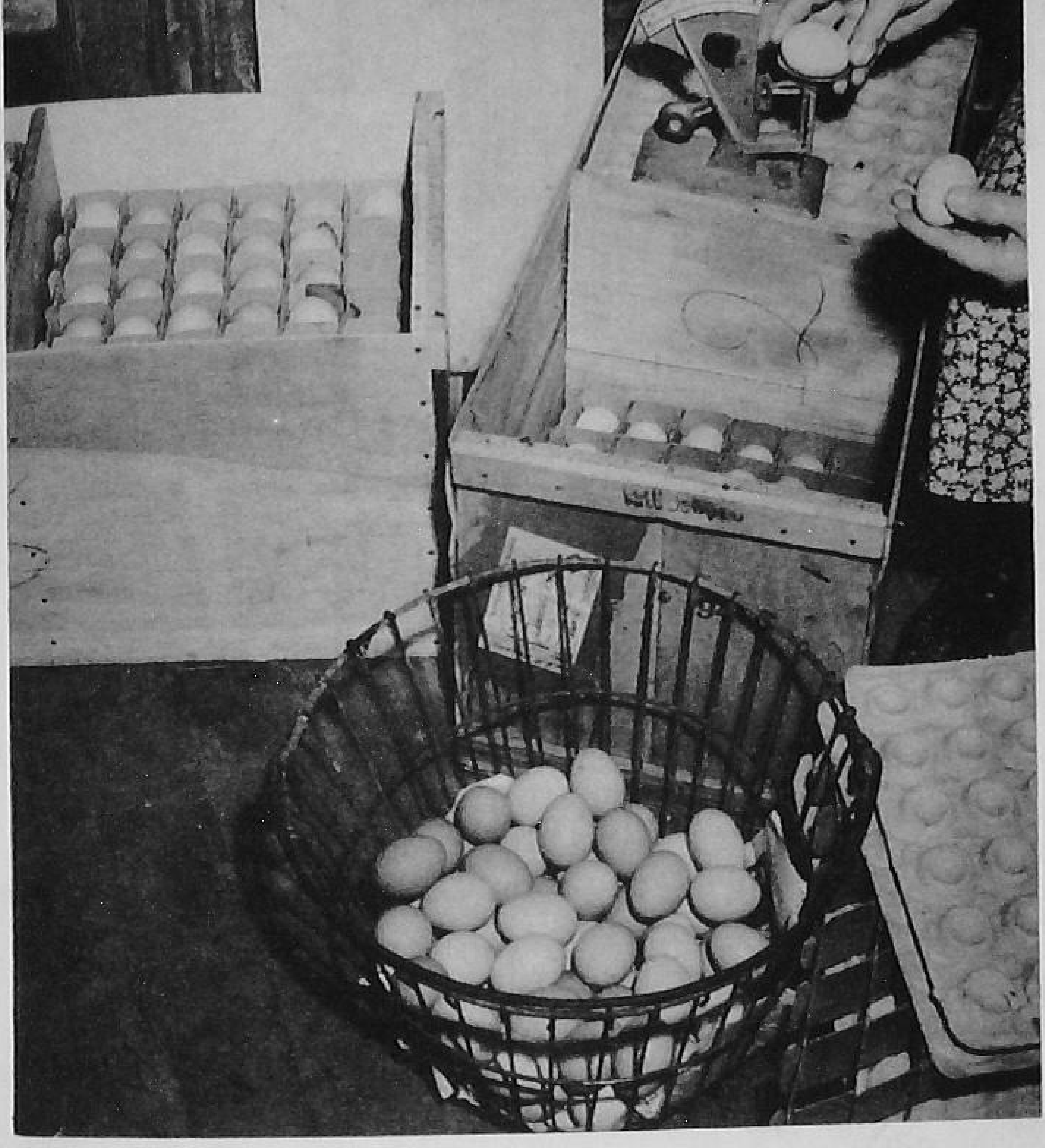


FIGURE 341. *Wire baskets should be used in gathering and cooling eggs.* (Courtesy Broiler Growing.)

are "Extras" and "Standards." The grades usually sell for a few cents more per dozen than do ungraded eggs.

Practices in Maintaining Egg Quality. The marketing of eggs begins as soon as they are laid. Fresh eggs have high quality, but a few hours of heat and dry air will lower the quality of an egg to second grade. The following practices will aid in maintaining the high quality of fresh eggs. No practice should be disregarded. It takes all of them to maintain high quality in the eggs produced.

1. Gather eggs twice a day in winter and three times a day in summer.
2. Use wire baskets for gathering and cooling eggs.
3. Cool the eggs overnight. Take them to a cool place immediately when gathered.
4. Case eggs after cooling in precooled cases.
5. Pack eggs with the small end down.

FIGURE 342. *Clean nests aid in producing clean eggs. (Courtesy* Poultry Tribune.)

6. Store eggs in cave or basement where temperature is 50° to 60° F. and the air is moist.
7. Sort out the small, irregular, and dirty eggs.
8. Keep male birds away from the laying flock. Produce infertile eggs.
9. Feed complete rations in adequate amounts.
10. Confine layers in morning during wet weather.
11. Clean soiled eggs with a brush or with a detergent and water.
12. Market eggs twice each week.
13. Sell eggs by grade.

MARKETING POULTRY

The rapid increase in turkey and broiler production has changed the poultry marketing picture. At one time practically all the poultry marketed in this country came from farm flocks, and in the main, was a by-product of egg production. Straight-run chicks were raised to produce pullets for the laying flock, and the cockerels were sold as fryers or roasters. The pullets were sold as hens after one production season.

In 1950 more pounds of commercial broilers and turkeys were marketed in this country than farm-raised chickens. According to USDA data, 1880 million pounds of commercial broilers, 828 million pounds of turkeys, 1074 million pounds of mature chickens, and 797 million pounds of farm-raised young chickens were marketed in this country in 1950. Broiler production has even increased since 1950.

The production of chicken and turkey broilers, and improved

methods of refrigeration, have helped to distribute marketing throughout the year and minimize seasonal price variations.

MARKET CLASSES OF POULTRY

Market classes are provided for chickens, turkeys, ducks, geese, guineas, and pigeons. Three classes are provided—live poultry, dressed poultry, and read-to-cook poultry. Most poultry sold by farmers is sold as live poultry, however the marketing of dressed and ready-to-cook birds is done on a small-scale by some farmers. Commercial producers may process the birds or sell them as live poultry.

Chickens. The following classes of chickens are specified by the Poultry Branch, Production and Marketing Administration of the United States Department of Agriculture.

Broiler or fryer. A broiler or fryer is a young chicken (usually under sixteen weeks of age) of either sex that is tender-meated with soft, smooth-textured skin and flexible breastbone cartilage.

Roaster. A roaster is a young chicken (usually under eight months of age) of either sex that is tender-meated with soft, pliable, smooth-textured skin and breastbone cartilage that is somewhat less flexible than that of a broiler or fryer.

Capon. A capon is an unsexed male chicken (usually under ten months of age) that is tender-meated with soft, pliable, smooth-textured skin.

Stag. A stag is a male chicken (usually under ten months of age) with coarse skin, somewhat toughened and darkened flesh, and considerable hardening of the breastbone cartilage. Stags show a condition of fleshing and a degree of maturity intermediate between that of a roaster and a cock or old rooster.

Hen or stewing chicken or fowl. These birds are mature female chickens (usually more than ten months old) with meat less tender than that of a roaster, and nonflexible breastbones.

Cock or old rooster. A cock or old rooster is a mature male chicken with coarse skin, toughened and darkened meat, and hardened breastbone.

Turkeys. The five official classes of turkeys follow.

Fryer or roaster. A fryer or roaster is a young, immature turkey (usually under sixteen weeks of age) of either sex that is tender-meated with soft, pliable, smooth-textured skin, and flexible breastbone cartilage.

Young hen turkey. A young hen turkey is a young female turkey (usually under eight months of age) that is tender-meated with soft, pliable, smooth-textured skin, and breastbone cartilage that is somewhat less flexible than in a turkey fryer or roaster.

Young tom turkey. A young tom turkey is a young male turkey (usually under eight months of age) that is tender-meated with soft, pliable, smooth-textured skin, and breastbone cartilage that is somewhat less flexible than in a turkey fryer or roaster.

Hen turkey. These birds are fully matured female turkeys (usually over ten months of age) that are less tender-meated than a young hen turkey, have hardened breastbones, and may have coarse-textured skin and patchy areas of surface fat.

Tom turkey. A tom turkey is a mature male turkey (usually over ten months of age) with coarse skin, toughened flesh, and hardened breastbone.

Ducks. Three classes of ducks are specified: (1) broiler duckling or fryer duckling, (2) roaster duckling, and (3) mature or older duck.

Geese. There are but two classes of geese: (1) young goose and (2) mature goose or old goose.

Guineas. Classes are provided for (1) young guineas and for (2) mature guineas or old guineas.

Pigeons. The two classes of pigeons that are specified: (1) squab and (2) pigeon.

MARKETING LIVE POULTRY

Much of the live poultry sold by producers goes directly, or through dealers, to commercial dressing plants. A common practice up to about 1930 was to ship live poultry in cars by rail to processing plants in our large cities. The practice was expensive, due to transportation costs and shrinkage. Processing and dressing plants are now located within trucking distance of practically all producers. Most live poultry is now transported by truck.

Finishing Poultry for Market. Most poultry dressing plants follow the practice of putting fowl purchased from farmers and commercial producers in batteries and feeding the birds heavily on soft feeds from two to four days before slaughtering them. The added finish improves the meat quality and the market grade of the carcass. Usually the weight increases are very profitable.

It is a good idea to confine for a few days the birds that are

going to be marketed, if satisfactory facilities are available, and to feed them heavily on a wet mash ration. If adequate and sanitary quarters cannot be provided, the birds can be hand-fed the wet mash rations while on range. This short feeding period will increase the market grade of the bird, and the added gain in weight will further increase the returns when the birds are sold.

Standards of Quality for Live Poultry. Official United States Standards for quality of individual live birds have been set up for the classes described earlier in this chapter. The following factors are considered in determining the quality of an individual bird: (1) health and vigor; (2) feathering; (3) conformation; (4) fleshing and fat covering; and (5) the degree of freedom from defects.

Three standards of quality are specified: (1) A or No. 1 Quality; (2) B or No. 2 Quality; and (3) C or No. 3 Quality. A description of the minimum requirements and maximum defects permitted in each of the quality standards is shown in Table 57.

TABLE 57

Summary of Standards of Quality for Live Poultry on an Individual Bird Basis (Minimum Requirements and Maximum Defects Permitted) United States Department of Agriculture Production and Marketing Administration

Factor	*A or No. 1 Quality*	*B or No. 2 Quality*	*C or No. 3 Quality*
HEALTH AND VIGOR:	Alert, bright eyes, healthy, vigorous.	Good health and vigor	Lacking in vigor
FEATHERING:	Well-covered with feathers showing luster or sheen. Slight scattering of pin feathers.	Fairly well-covered with feathers Moderate number of pin feathers.	Complete lack of plumage feathers on back. Large number of pin feathers.
CONFORMATION: Breast bone	Normal. Slight curve ⅛" dent (chickens), ¼" dent (turkeys)	Practically normal Slightly crooked	Abnormal Crooked
Back	Normal (except slight curve)	Moderately crooked	Crooked or hunched back.
Legs and wings	Normal	Slightly misshapen	Misshapen.
FLESHING:	Well fleshed, moderately broad, and long breast.	Fairly well fleshed.	Poorly developed narrow breast, thin covering of flesh.
FAT COVERING:	Well covered, some fat under skin over entire carcass. Chicken fryers and turkey fryers and young toms only moderate covering. No excess abdominal fat.	Enough fat on breast and legs to prevent a distinct appearance of flesh through skin. Hens or fowl may have excessive abdominal fat.	Lacking in fat covering on back and thighs, small amount in feather tracks.
DEFECTS:	Slight	Moderate	Serious
Tears and broken bones	Free	Free	Free
Bruises, scratches, and callouses	Slight skin bruises, scratches, and callouses.	Moderate (except only slight flesh bruises)	Unlimited to extent no part unfit for food.
SHANKS:	Slightly scaly	Moderately scaly	Seriously scaly.

MARKETING DRESSED AND READY-TO-COOK POULTRY

Consumers buy very little live poultry. Most of the poultry sold to consumers is sold as dressed or ready-to-cook fowl.

Dressed Fowl. The term dressed fowl refers to birds which have been slaughtered, bled, and have had the feathers removed. Dressed birds are usually sold as fresh-killed poultry. The dressed carcass weighs from 9 to 12 per cent less than the live weight of the bird. Blood accounts for from 4 to 6 per cent and feathers for from 5 to 7 per cent of the loss in weight.

Ready-to-Cook Poultry. Much of the poultry on the consumer market is ready-to-cook poultry. The birds have been slaughtered and bled, and the feathers, entrails, head, feet, and shanks have been removed. The gizzard, liver, heart, and neck are usually wrapped in waxed paper and placed inside the bird. The carcass may or may not be cut up for frying.

A 3-pound broiler will produce a dressed carcass weighing from about 2.6 to 2.7 pounds, and an eviscerated or ready-to-cook carcass (with giblets) weighing about 2.1 pounds. A 6-pound roaster will yield a 5.3- to 5.4-pound dressed carcass, and a 4.2- to 4.4-pound ready-to-cook carcass. The loss in dressing and drawing usually amounts to 25 to 35 per cent.

Standards of Quality for Dressed and Ready-to-Cook Poultry. Official standards for quality of individual dressed and ready-to-cook poultry have been outlined by the Poultry Branch of the Production and Marketing Administration. The factors considered in determining the quality of an individual carcass are as follows: (1) conformaton; (2) fleshing; (3) fat covering; (4) freedom from pinfeathers; (5) freedom from cuts and tears and disjointed and broken bones; (6) freedom from discolorations of skin and from flesh blemishes and bruises; and (7) freedom from freezer burn.

In the standards of quality for individual carcasses the terms "normal," "practically normal," and "abnormal" refer to A Quality, B Quality, and C Quality, respectively. These are the three grades applied to individual birds and to wholesale lots of poultry. The minimum requirements and maximum defects permitted in each of the quality or grade standards for dressed and ready-to-cook chickens are shown in Table 58. The minimum requirements and allowable defects in the quality standards for dressed and ready-to-cook turkey are presented in Table 59.

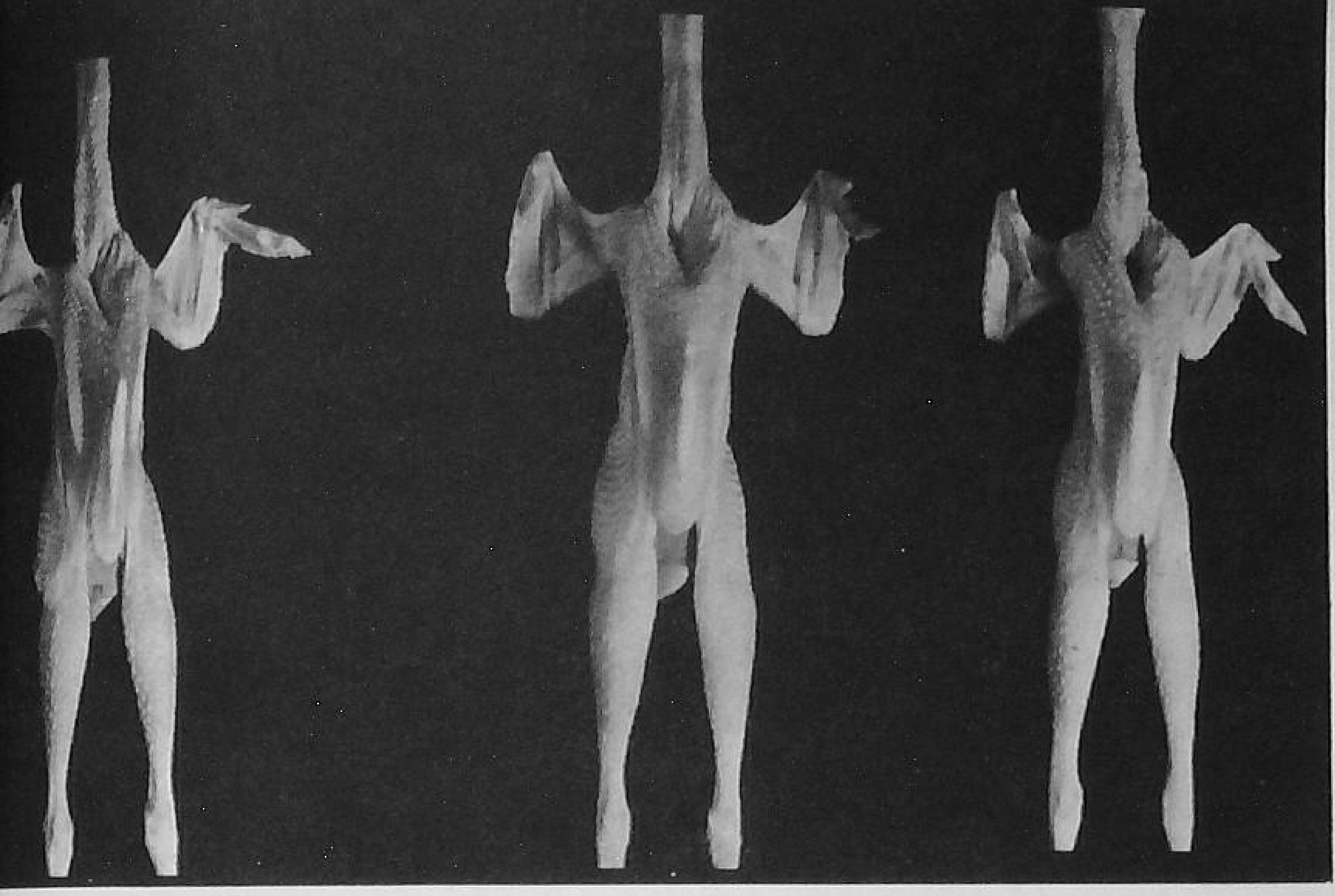
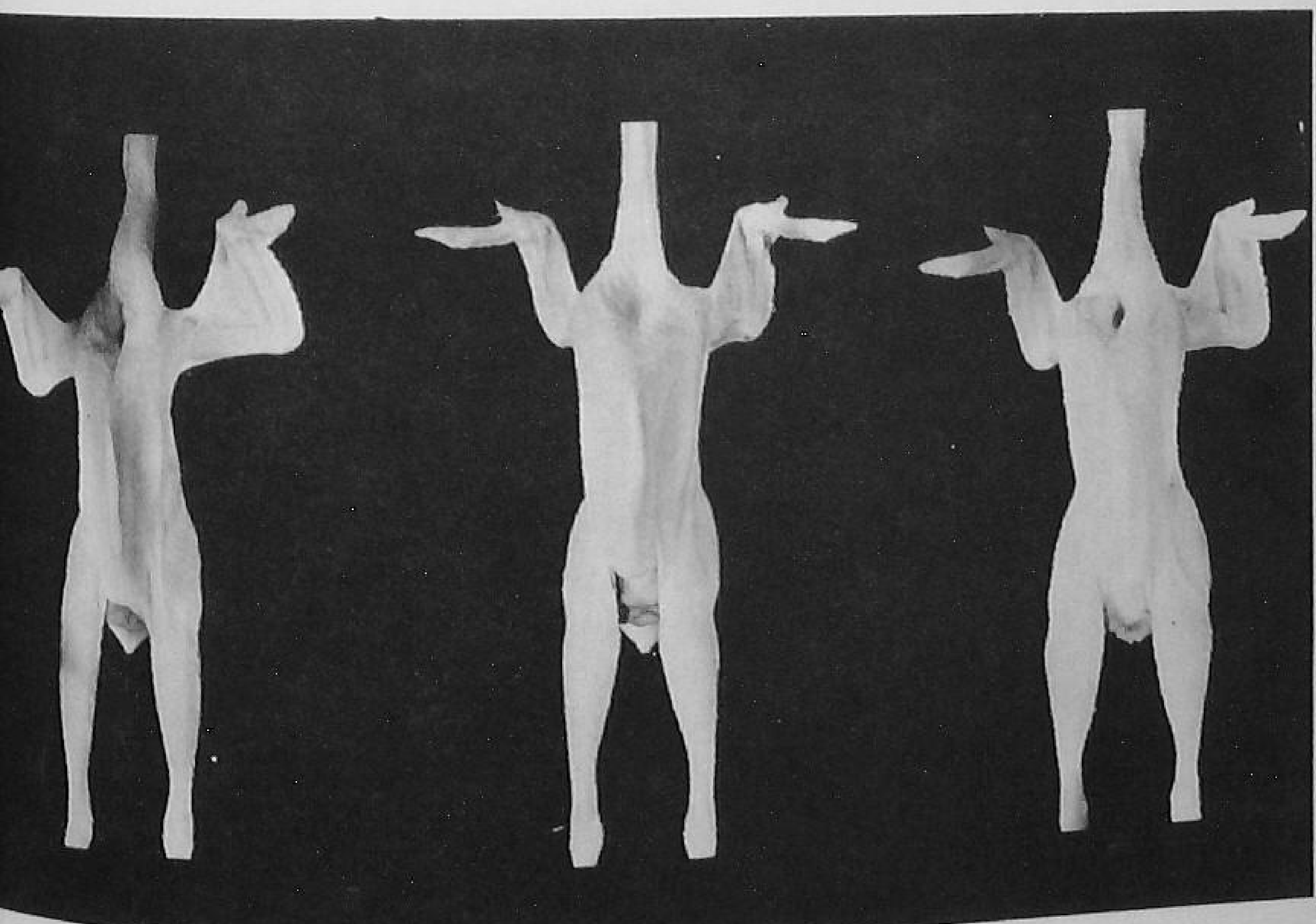


FIGURE 343. *Ready-to-eat broiler carcasses. (left) C quality, (center) B quality, (right) A quality. (Courtesy U.S.D.A. Production and Marketing Administration.)*

FIGURE 344. *Ready-to-eat stewing chicken carcasses. (left) C quality, (center) B quality, (right) A quality. (Courtesy U.S.D.A. Production and Marketing Administration.)*



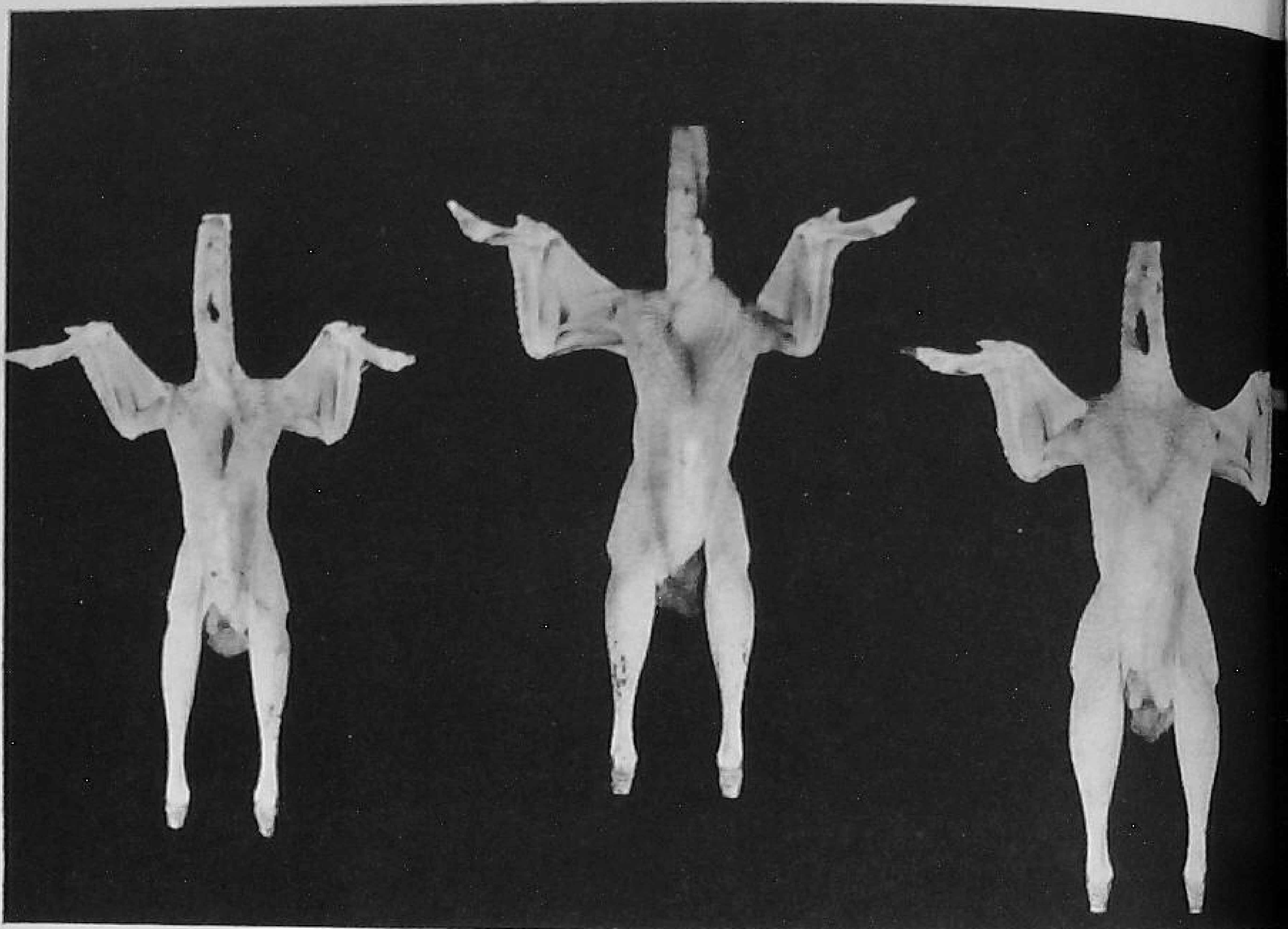


FIGURE 345. *Ready-to-eat young tom turkey carcasses. (left) C quality, (center) B quality, (right) A quality. (Courtesy U.S.D.A. Production and Marketing Administration.)*

Weight Specifications. Dressed and ready-to-cook poultry is also sold according to weight specifications. The carcasses are weighed and grouped. Broilers, roasters, and hen classifications are at ½-pound intervals, while capon, stag, and cock classifications are based upon 1-pound differences in weights. The classifications of turkeys and geese are based upon 2-pound differences in weights.

Turkey hens and light weight birds bring higher prices than toms and heavy birds. The discount for heavy birds is greatest in the spring. The average weight of all turkeys marketed in 1950 was 18.6 pounds. Small-type turkeys made up 16 per cent of the 1951 turkey crop. Turkeys have to mature before they can be finished, and only early maturing birds can be marketed at light weights, and produce high quality carcasses.

Seasonal Price Trends. Nearly 50 per cent of the poultry produced in this country is marketed in the months of October, November, December, and January. The increase in broiler production is helping to spread production throughout the year and

decrease seasonal price differences. The freezing of poultry has also helped to minimize seasonal price differences.

As shown in Figure 337 the average price of chickens during the months of October, November, and December for the 1948–1952 period was 20.6 cents per pound. The average price during the February, March, and April period was 22.7 cents. Chickens sold in July, August, and September also sold for an average of 22.7 cents. It will pay to plan production and marketing so that the birds will be sold during the periods of high prices.

Improved Meat-Type Poultry. National Chicken-of-Tomorrow contests have been conducted since 1946 to encourage the development of a chicken with a higher percentage of the carcass in the breast, thighs, and legs. Considerable progress has been made.

FIGURE 346. *Cross sections of Chicken-of-Tomorrow wax models. The center carcass is the average market-type bird at twelve weeks. Left shows progress made to date. The carcass on the right is the ideal. (Courtesy* Broiler Growing.)

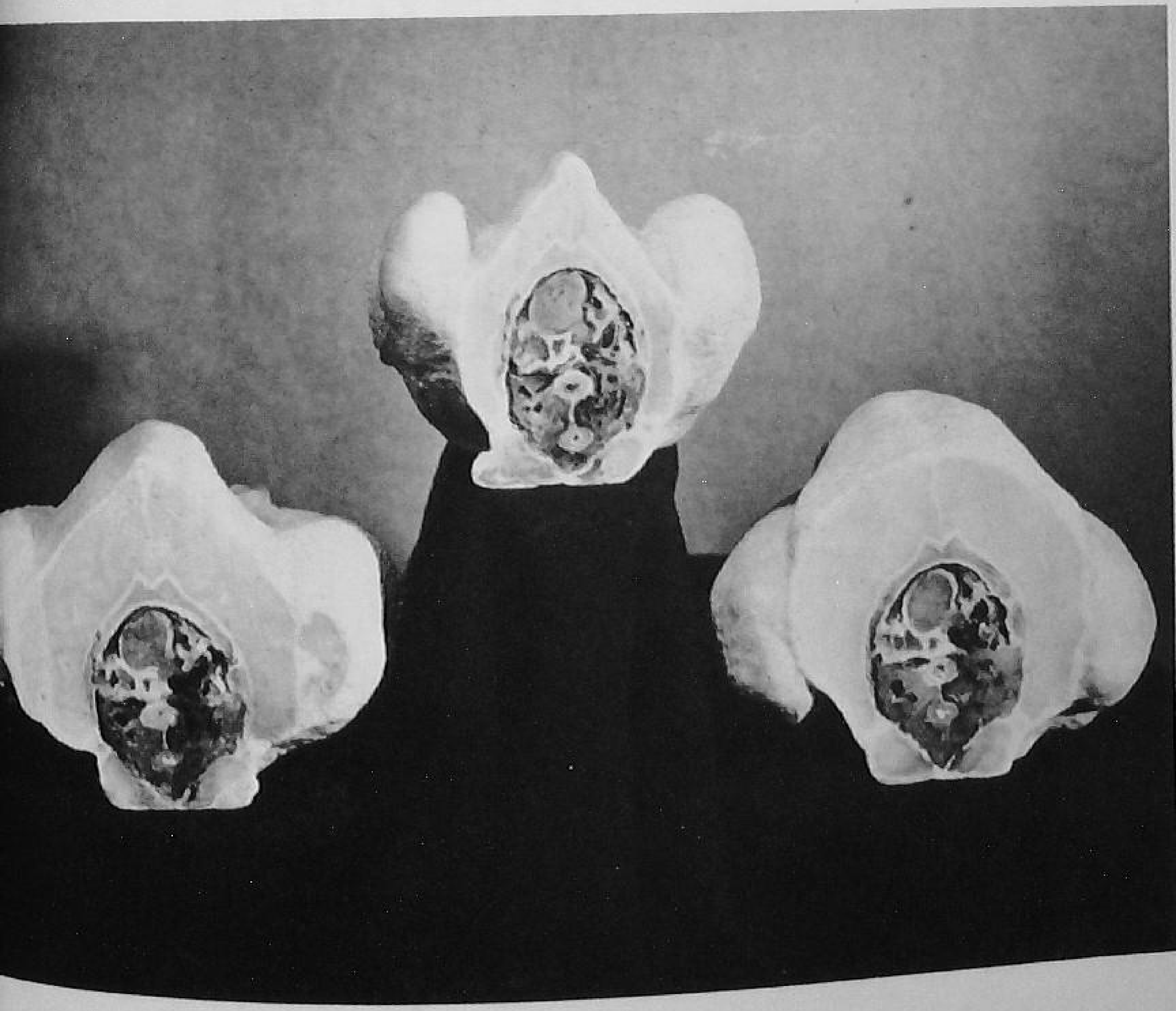


TABLE 58

SUMMARY OF STANDARDS FOR QUALITY OF DRESSED AND READY-TO-COOK CHICKENS
(MINIMUM REQUIREMENTS AND MAXIMUM DEFECTS PERMITTED)
UNITED STATES DEPARTMENT OF AGRICULTURE PRODUCTION AND MARKETING ADMINISTRATION

Factor	*A Quality*	*B Quality*	*C Quality*
CONFORMATION:	Normal	Practically normal	Abnormal
Breastbone	Slight curve ⅛″ dent	Dented, curved, slightly crooked	Seriously crooked
Back	Normal (except slight curve)	Moderately crooked	Seriously crooked
Legs and wings	Normal	Moderately misshapen	Misshapen
FLESHING:	Well fleshed, moderately long and broad breast	Fairly well fleshed on breast and legs	Poorly fleshed
Breastbone	Not prominent	Not prominent	May be prominent
FAT COVERING:	Well covered—some fat under skin over entire carcass	Sufficient fat on breast and legs to prevent a distinct appearance of flesh through skin.	Lacking in fat covering over all parts of carcass.

PINFEATHERS:	*Breast and Legs*	*Elsewhere*	*Breast Legs*	*Elsewhere*	*Breast Legs*	*Elsewhere*
Dressed—pins—hair	Pract. free	Pract. free	Relatively few	Slight scattering	Numerous	Numerous
READY-TO-COOK:						
Nonprotruding pins	Pract. free	Pract. free	Few, scattered	Few, scattered	Scattering	Scattering
Hair	Pract. free	Pract. free	Few, scattered	Few, scattered	Few, scattered	Few, scattered
Protruding pins	Free	Free	Free	Free	Free	Free
CUTS AND TEARS *	Free	1½"	1½"	3"	No limit	
Disjointed bones	1		2		No limit	
Broken bones	None (except one non-protruding wing bone if broiler or fryer)		Non-protruding		No limit	
DISCOLORATIONS: †						
Flesh bruises	0"	½"	½"	1½"	No limit ‡	
Skin bruises	½"	¾"	¾"	1½"	No limit ‡	
All discolorations	1"	1½"	1½"	3"	No limit ‡	
FREEZER BURN	Few, small (⅛" diameter) pockmarks		Moderate—dried areas not in excess of ½" in diameter.		Numerous pockmarks and large dried areas.	

The quality designations specified herein are not applicable to birds possessing any of the following conditions: dirty or bloody head or carcass, dirty feet or vent, fan feathers or neck feathers or garter feathers, or feed in the crop.

* Total aggregate length of all cuts and tears including incision for removal of the crop or its contents.
† Maximum diameter of aggregate areas of all flesh bruises, skin bruises, and discolorations.
‡ No limit on size and number of areas of discoloration and flesh bruises if such areas do not render any part of the carcass unfit for food.

TABLE 59

SUMMARY OF STANDARDS FOR QUALITY OF DRESSED AND READY-TO-COOK TURKEYS
(MINIMUM REQUIREMENTS AND MAXIMUM DEFECTS PERMITTED)
UNITED STATES DEPARTMENT OF AGRICULTURE PRODUCTION AND MARKETING ADMINISTRATION

Factor	*A Quality*	*B Quality*	*C Quality*
CONFORMATION:	Normal	Practically normal	Abnormal
Breastbone	Slight curve, ¼″ dent	Dented, curved, slightly crooked	Seriously crooked (If fairly well fleshed)
Back	Normal (except slight curve)	Moderately crooked	Seriously crooked (If fairly well fleshed)
Legs and wings	Normal	Moderately misshapen	Misshapen
FLESHING:	Well fleshed, moderately long and broad breast	Fairly well fleshed on breast and legs	Poorly fleshed
Breastbone	Not prominent	Not prominent	May be prominent
Pouchiness	Slight	Definite	Extended
FAT COVERING:	Well covered—some fat under skin over entire carcass Young toms only moderate covering Fryers or roaster somewhat lacking in fat	Sufficient fat on breast and legs to prevent a distinct appearance of flesh through skin	Lacking in fat covering over all parts of carcass

PINFEATHERS:	*Breast and Legs*	*Elsewhere*	*Breast and Legs*	*Elsewhere*	*Breast and Legs*	*Elsewhere*
Dressed						
pins and hair	Pract. free	Pract. free	Relatively few	Slight scattering	Numerous	Numerous
Ready-to-cook						
nonprotruding pins	Pract. free	Pract. free	Few, scattered	Few, scattered	Scattering	Scattering
hair	Pract. free	Pract. free			Few, scattered	Few, scattered
Protruding pins	Free	Free	Free	Free	Free	Free
CUTS AND TEARS: *	Free	3″	3″	6″	No limit	
Disjointed bones	1		2		No limit	
Broken bones	None		1 nonprotruding		No limit	
DISCOLORATIONS: †						
Flesh bruises	0	1″	1″	3″	No limit ‡	
Skin bruises	¾″	1½″	1½″	3″	No limit ‡	
All discolorations	2″	3″	3″	6″	No limit ‡	
FREEZER BURN:	Few, small (⅛″ diameter) pockmarks		Moderate—dried areas not in excess of ½″ in diameter		Numerous pockmarks and large dried areas	

The quality designations specified herein are not applicable to birds possessing any of the following conditions: dirty or bloody head or carcass, dirty feet or vent, fan feathers or neck feathers or garter feathers, or feed in the crop.

* Total aggregate length of all cuts and tears including incision for removal of the crop or its contents.

† Maximum diameter of aggregate areas of all flesh bruises, skin bruises, and discolorations.

‡ No limit on size and number of areas of discoloration and flesh bruises if such areas do not render any part of the carcass unfit for food.

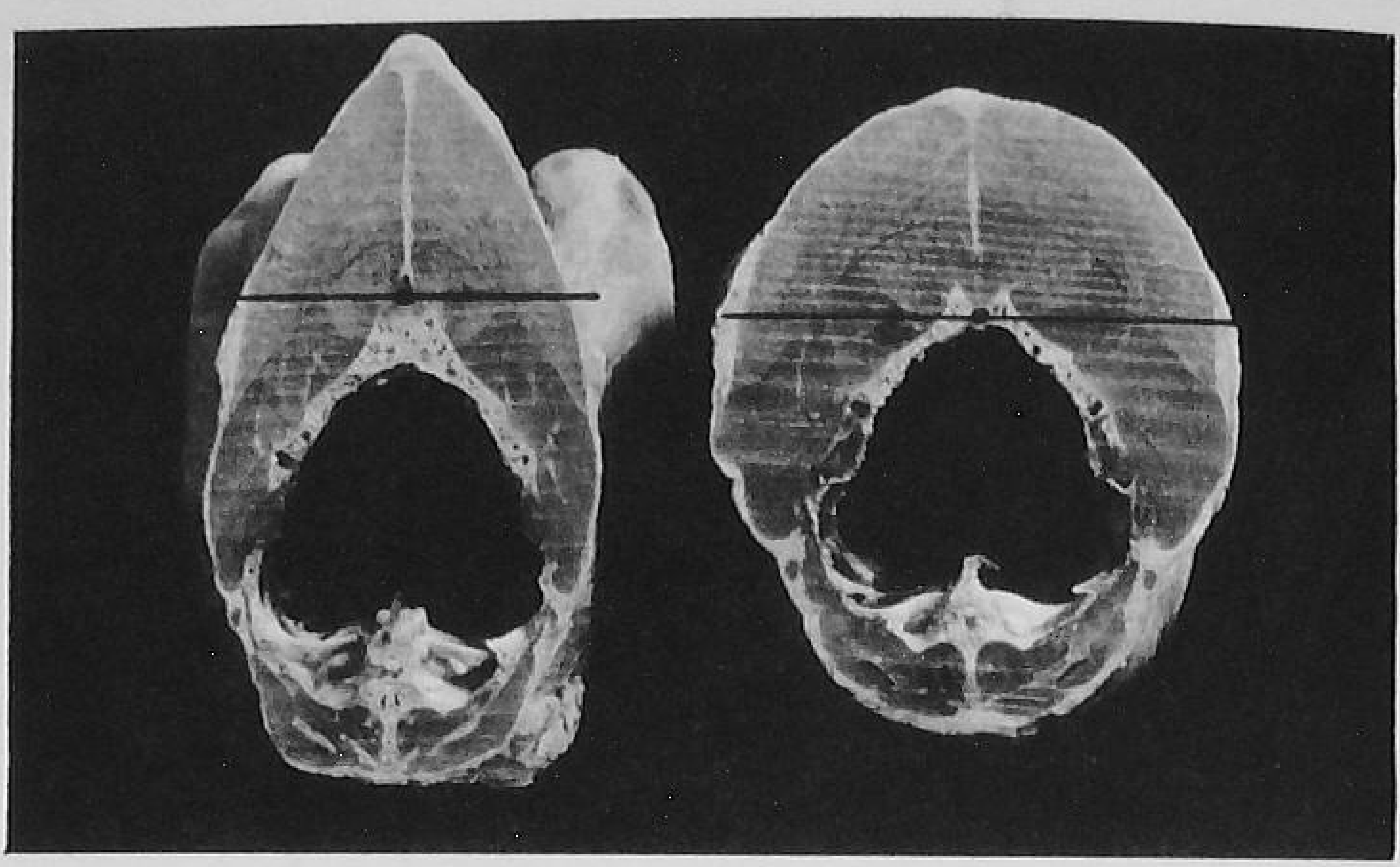


FIGURE 347. *Cross sections of the breasts of the standard and broad-breast turkey carcasses. (Courtesy* Turkey World.)

The Broad Breasted Bronze Turkey has done much to improve the carcasses of heavy turkeys. Nearly 80 per cent of the turkeys produced in this country carry Broad Breasted Bronze breeding.

The Small White Beltsville turkey has become popular because of its early maturity and good quality carcass. Our best lightweight turkeys are of this breed.

SUMMARY

Increased returns from the poultry enterprise may be obtained by (1) marketing poultry and eggs during the periods of high prices, (2) by improving the quality of the poultry products, and (3) by a careful selection of the method of marketing. Eggs sold in August, September, October, and November sell for several cents more per dozen than eggs sold in February, March, and April. Pullets should be started in January, February, and March so that heavy egg marketings can be made in the fall.

The four United States consumer grades of eggs are AA Quality, A Quality, B Quality and C Quality. The quality is determined by candling the egg. Albumen quality, freedom from defects, shell quality, and age are important in determining egg quality.

Eggs are classed according to size as extra large, large, medium, and small. Most commercial eggs are sold as ungraded or as "extras" or "standards."

To improve egg quality, gather eggs several times a day; cool them in a wire basket in a cool, moist room; case them the follow-

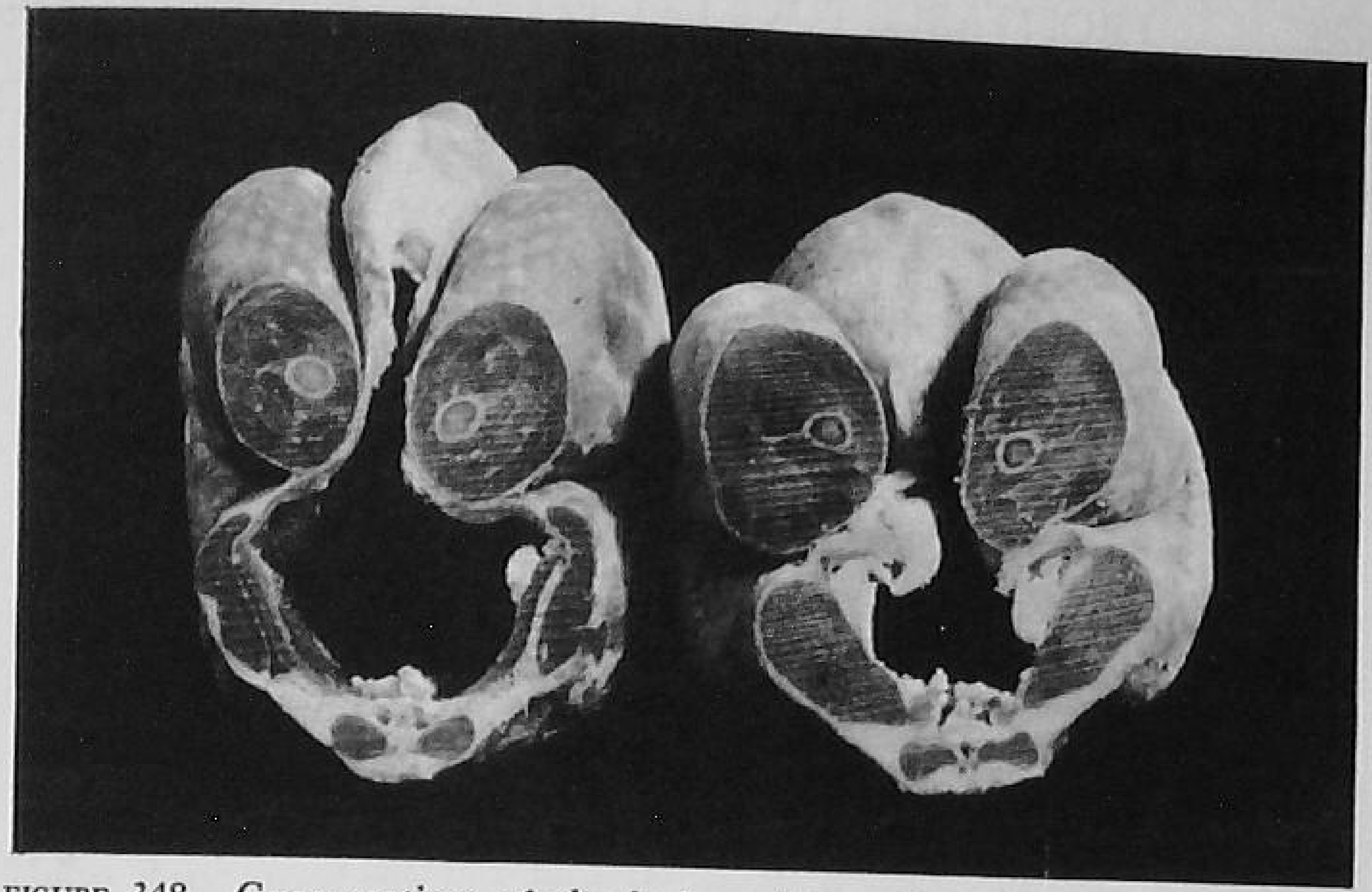


FIGURE 348. *Cross sections of the backs and legs of standard and broad-breast turkey carcasses. (Courtesy* Turkey World.)

ing morning, placing the large end up. Sort out small, irregular, and dirty eggs. Produce infertile eggs. Provide good nesting facilities. Marget eggs twice a week, and sell them by grade.

Chickens are sold as broilers, roasters, capons, stags, hens, or cocks. Turkeys are sold as fryers or roasters, young hen turkeys, young tom turkeys, hen turkeys, and tom turkeys. Live birds are graded according to health and vigor, feathering, conformation, fleshing, fat covering, and degree of freedom from defects. There are three standards of quality: A or No. 1 Quality, B or No. 2 Quality, and C or No. 3 Quality.

Dressed and ready-to-cook poultry is graded on conformation; fleshing; fat covering; freedom from pinfeathers; freedom from cuts, tears, and disjointed or broken bones; freedom from discolorations of skin and from flesh blemishes and bruises; and freedom from freezer burn. Three quality grades are used: A Quality, B Quality, and C Quality.

Best prices for poultry are received in the July, August, and September and in the February and March periods.

Heavy and tom turkeys sell for less than hens and lightweight finished turkeys.

Poultry carcass grades may be improved by using improved meat-type breeding stock, by feeding birds a wet mash ration in confinement a few days before marketing them, and by marketing them at desired finish and maturity.

QUESTIONS

1. Egg prices are highest during which months of the year?
2. What are the characteristics of each of the consumer grades of eggs?
3. What are the advantages and disadvantages of selling eggs by grade?
4. Outline a program for improving the quality and the marketing of eggs on your farm.
5. What are the weight classes of eggs?
6. Does it pay to clean dirty eggs? Why?
7. What are the market classes of chickens and turkeys?
8. Plan a feeding program for finishing broilers, roasters, and turkeys for market.
9. Describe the standards of quality and the grades for live poultry.
10. What is the difference between dressed and ready-to-cook poultry?
11. What are the standards of quality and the grades of dressed and ready-to-cook fowl?
12. During which months will chickens sell for the highest prices?
13. Why do tom and large turkeys sell for more per pound than hen and small turkeys?
14. Outline a program for improving the quality and methods of marketing poultry on your farm.

REFERENCES

Botsford, Harold F., *The Economics of Poultry Management*, John Wiley and Sons Inc., New York, 1952.

Charles, T. Burr, and Stuart, Homer O., *Commercial Poultry Farming*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Darrah, L. B., *Business Aspects of Commercial Poultry Farming*, The Ronald Press Company, New York, 1952.

Goble, J. W., and Filley, H. C., *Marketing Poultry and Eggs in Nebraska*, Bulletin 398, University of Nebraska, 1950.

Hauver, W. E., *Digest of Poultry Grading and Inspection Regulations, Standards and Grades*, Poultry Branch, Production and Marketing Administration, United States Department of Agriculture, 1952.

Norton, L. J., *et al.*, *Grading Will Improve the Market for Illinois Eggs*, Circular 631, University of Illinois, 1948.

Production and Marketing Administration, *United States Standards, Grades, and Weight Classes for Shell Eggs*, Poultry Branch, United States Department of Agriculture, 1952.

Winner, E. B., *et al.*, *Producing and Marketing Quality Eggs*, Circular 621, University of Missouri, 1952.

Reproduction and Inheritance

< 36 >

Reproduction, Inheritance, and Pedigrees in Animal Breeding

Much of the improvement in the conformation and type of livestock has come about through the use of carefully planned breeding programs. An understanding of the basic principles in reproduction and inheritance is essential in planning livestock breeding programs. These principles are much the same, regardless of the type of animal, but there may be variations in application. We present in this chapter a brief explanation of (1) reproduction, (2) the reproductive organs of male and female animals, (3) the laws of inheritance which affect reproduction, and (4) the value of pedigree information in animal breeding.

REPRODUCTION

Reproduction is the process by which new individuals are produced in plant and animal life and begins when the female germ cell is fertilized by the male germ cell. The female cell is called the *ovum*, or egg, and the male cell is called the *sperm*. This fertilization process follows closely the breeding of the female by the male.

The egg or ovum contains the hereditary materials of the mother, while the sperm contains the materials of inheritance contributed by the father or sire. The contributions of the sire and dam, so far as inheritance is concerned, are equal. The fertilization of the egg, however, takes place within the body of the mother, and the offspring is nourished and protected by the mother until birth.

Female Reproductive Organs. As shown in Figure 349, the reproductive system of the female consists of the ovaries, the oviducts, the uterus, the vagina, and the vulva.

Ovaries. These two glandular organs are located in the sub-

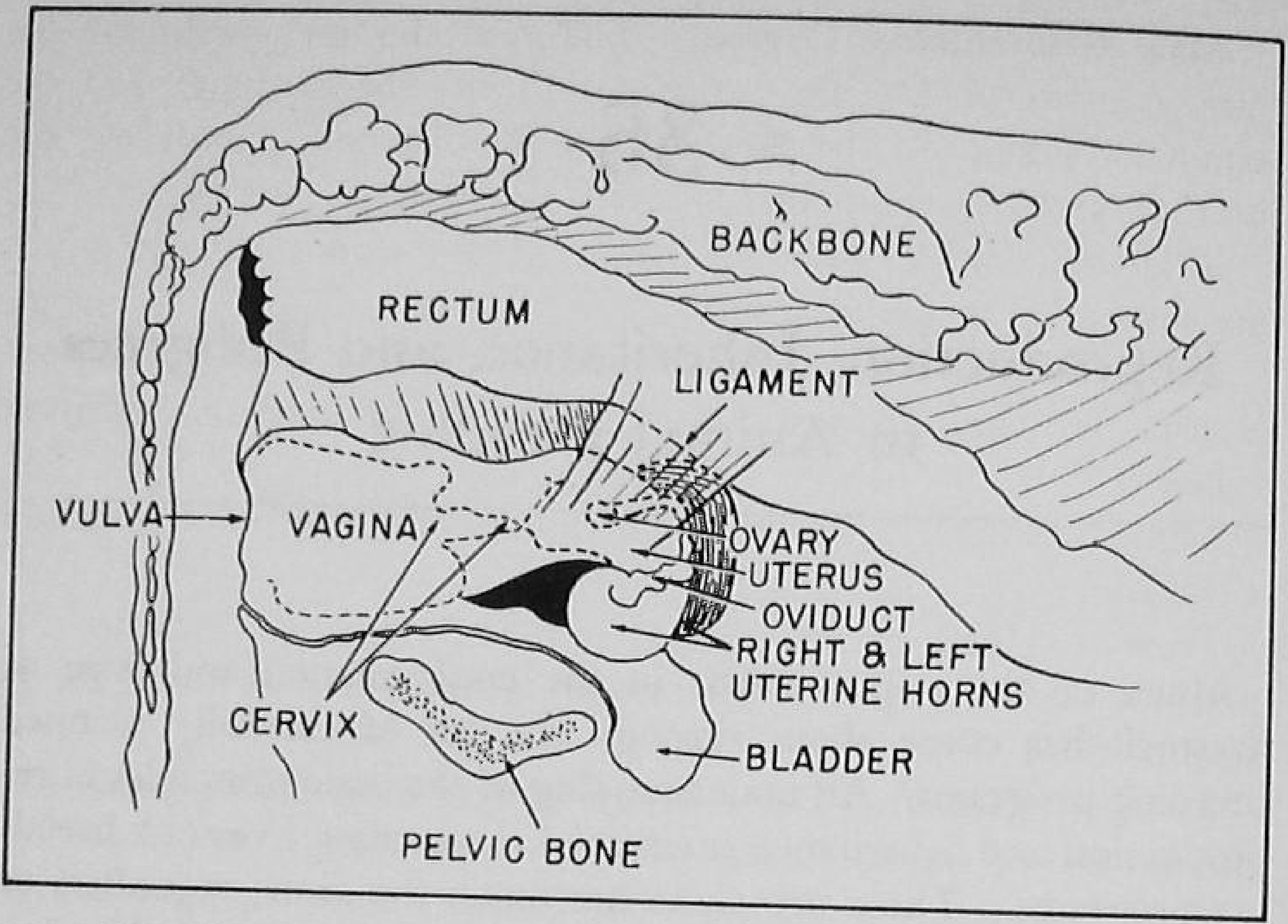


FIGURE 349. *Reproductive organs of a cow. (Drawing by Francis G. Telshaw.)*

lumbar region, and produce the eggs. Each ovary contains many follicles in which the eggs are produced. As the eggs mature they are dropped into the oviduct. The process is called ovulation, and takes place during or shortly after the heat period.

A sow usually ovulates the second day of the heat period, cows about twenty-four hours after going out of heat, and ewes ovulate about six hours before and after the passing of the heat period. Animals should be bred as closely to the time of ovulation as possible.

Oviducts. These tubes lead from the ovaries to the horns of the uterus. The fertilization of the egg usually takes place near the upper end of the oviduct.

Uterus. The uterus is a hollow organ containing two horns which are connected to the oviducts. The fertilized egg moves from the oviduct into the uterus and becomes attached to the wall. The fertilized egg develops in the uterus.

The cervix is the neck of the uterus and separates it from the vagina.

Vagina. The vagina connects the vulva and the cervix.

Vulva. Both the urinary and reproductive organs of the female terminate in the vulva.

Male Reproductive Organs. The reproductive system of the male consists of (1) the testicles, (2) the sperm ducts, (3) the seminal vesicles, (4) the prostate, (5) the Cowper's glands, (6) the urethra, and (7) the penis.

Testicles. Sperm cells are produced in the two testicles which are suspended in the scrotum.

Sperm ducts. These tubes connect the testicles with the urethra. Sperms pass through, and may be stored at, the upper end of these tubes.

Seminal vesicles. These glands open to the urethra and secrete a fluid.

Prostate. The prostate gland is located near the bladder and urethra. It also produces a secretion which becomes a part of the seminal fluid.

Cowper's Glands. These glands secrete a fluid which precedes the passage of the sperm cells down the urethra.

Penis. This organ deposits the sperm cells within the female reproductive system.

Urethra. This long tube extends from the bladder to the penis and carries urine, and serves also as a duct for semen.

LAWS OF INHERITANCE

Chromosomes and Genes. Each germ cell (sperm and egg) contains chromosomes which in turn carry genes. The genes determine the characteristics to be found in the individual. The color of hair, the conformation of the body, the type, and other characteristics are determined by the genes in the germ cells.

The number of chromosomes in the nucleus of a cell is constant. They occur in pairs. In swine there are nineteen pairs, while in sheep, cattle, and horses there are thirty pairs. The members of each pair carry genes which affect the same characters or physical conditions of the animal, but they may not affect them in the same way. For example, in swine breeding factor A on chromosome 1 may affect color of hair by producing black color, while factor A on the other chromosome of the pair produces a red color. If neither color is dominant, the progeny will possess both colors.

Dominant and Recessive Characters. When a white boar is mated to a red sow, the pigs are white. When a polled bull is mated to a horned cow, the offspring is polled. Certain characteristics are dominant while others are recessive. White color in

swine is dominant. The horned character in cattle is recessive. When dominant and recessive characters are brought together, the progeny will possess the dominant characteristics, but will produce in the next generation some animals which will show the dominant characters while others possess the appearance of the recessive.

Hybrid. An animal is considered a hybrid for any one character when it possesses one dominant and one recessive gene. When a hybrid is crossed with another hybrid, about 75 per cent of the progeny will show the characteristics of the dominant, and 25 per cent will show recessive characteristics. Of the 75 per cent of the progeny which show dominance, only about one-third are pure dominant for the one character. The other two-thirds have the appearance of the dominant but are hybrid. Those which show recessive characteristics are pure recessives.

Chromosome Segregation. The normal reproductive cell in cattle contains thirty pairs of chromosomes, yet when two cells are brought together there are still but thirty pairs of chromosomes. A reduction process takes place in the process of germ cell production which reduces the number of chromosomes by one-half. Only one chromosome of each pair is included in the germ cell. The bringing together of the two germ cells through fertilization restores the normal number of chromosomes.

Hybrid Vigor. The crossing of two superior animals of different breeds usually results in increased growth rate, efficiency of fertilization, and in improvement in body conformation. Crossbreeding in hogs, cattle, sheep, and chickens has been done for years, but not until rather recently has it been done on a truly scientific basis.

Heterosis, or hybrid vigor, is the term applied to the increase in vigor and performance resulting when two animals of unrelated breeds are crossed. The increase in vigor may be explained in terms of the genetic principles discussed in previous paragraphs. The genes producing vigor are dominant to those producing a lack of vigor. By crossing breeds, a larger number of dominant genes are brought together in the progeny than are involved in breeding animals of the same breed. It is thought, also, that animals of the various breeds differ in the factors which contribute toward vigor. A greater number of vigor-producing factors are involved when breeds are crossed than when matings are made of animals of the same breed. The problem in crossbreeding is to determine

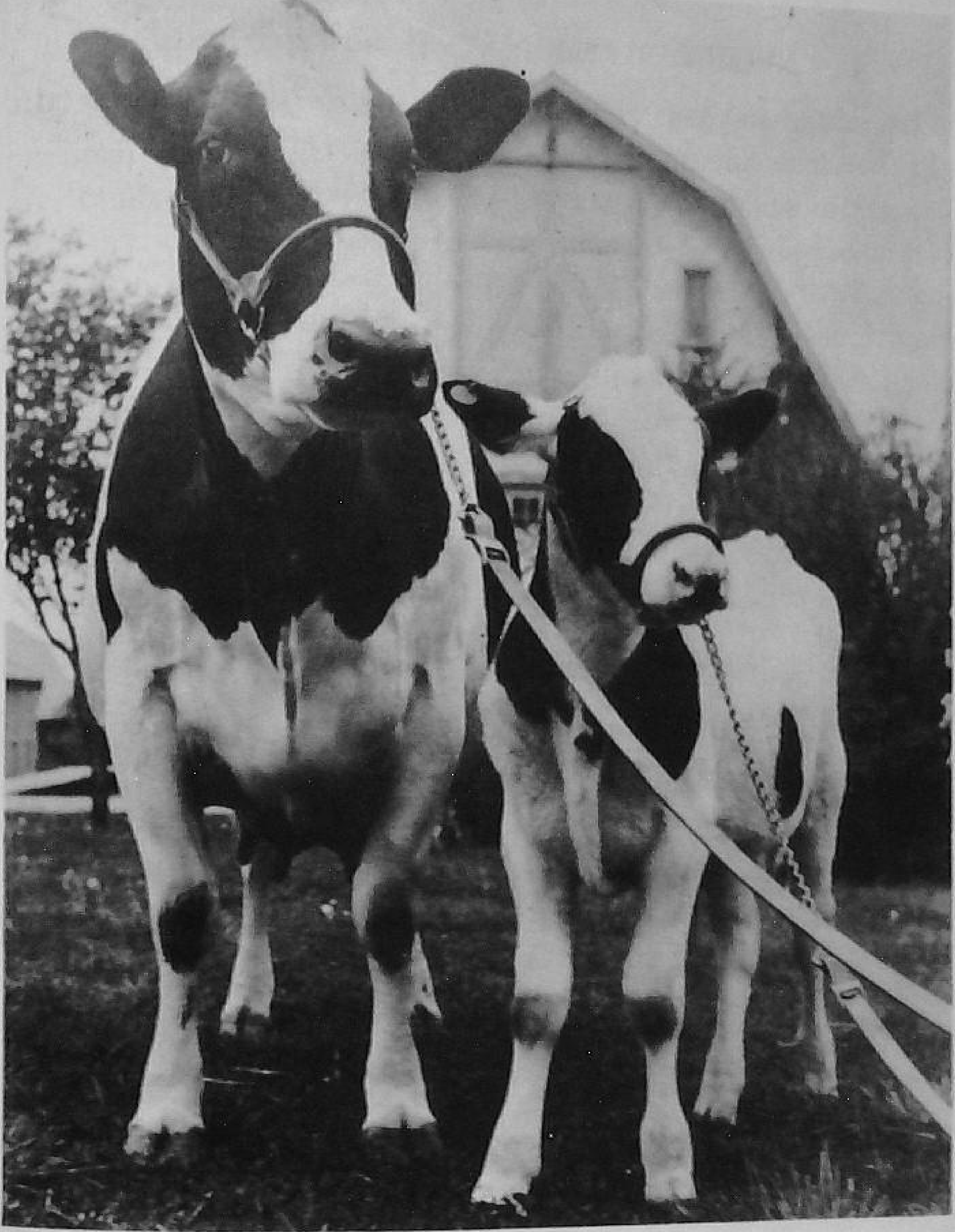


FIGURE 350. *Note the similarity in color markings of this cow and her calf. (Courtesy Holstein-Friesian Association of America.)*

the crosses which produce the most hybrid vigor.

Grading and Purebreeding. These two systems of breeding involve the mating of animals of the same breed. Grading-up involves the mating of pureberd sires and grade females of the same breed. Purebreeding involves the mating of purebred sires and purebred females of the same breed. In both cases animals to be mated are selected according to their body conformation, vigor, growth rate, and production record. Purebred animals are quite homozygous. The genes are usually alike. The hybrid condition referred to previously does not exist. The animals tend to reproduce progeny like themselves—"like begets like."

Inbreeding and Linebreeding. Inbreeding is the mating of such closely related animals as (1) brother to sister, (2) son to dam, and (3) sire to daughter. It is done primarily to intensify the degree of homozygosity, or the similarity of the genes in the reproductive cells of the animals. The crossing of inbred lines of two or more breeds results in hybrid vigor greater than that produced when two or more noninbred lines are crossed.

Linebreeding is similar to inbreeding but involves the breeding of animals less closely related. The mating of cousins, and grandsire or granddaughters, are examples of linebreeding. It is done to conserve and perpetuate the good traits of certain outstanding breeding animals. It tends to produce a homozygous genetic condition.

VALUE OF PEDIGREES IN ANIMAL BREEDING

Pedigree information is very valuable in livestock breeding. Most breeding programs involve the use of purebred sires for which pedigree information is available, and some breeding programs involve females which are purebred. A careful analysis of the pedigree may indicate the prolificacy, productiveness, and conformation of the animal and of its progeny.

The following is the pedigree information for a Duroc boar which appeared in a sale catalog:

Pedigree

Name: Perfection's Kind 351135
Bred by Willard Klein, Iowa Falls, Iowa.
Farrowed: February 26, 1952. Number in litter: 10.
Ear notches: 1UR & 2LR

Sire: Perfection Chief 252341	Jonesway Perfection 112701
	Jonesway Red Miss 111332
Dam: Gold Susie 258574	Gold Heir 435667
	Miss Orion 44430

Perfection's Kind was the 1952 Iowa Junior Champion Boar. His sire, Perfection Chief, was a son of Jonesway Perfection 112701, the Grand Champion Boar at the Kentucky State Fair. Gold Heir sired the 1950 Iowa Junior Champion boar and was a

grandson of Reconstruction Improver, the sire of several outstanding breeding boars in Indiana and Illinois. This information is helpful to the buyer of breeding stock.

Pedigrees of dairy animals not only provide a list of the ancestors but may also provide the production records of the animals. Shown is an extended pedigree of a young Holstein bull. Note that ancestry and production information are provided for the sire and dam, for the grandsires and granddams, and for the great grandsires and great granddams. This pedigree is more complete than most pedigrees but shows the type of information which may be available concerning breeding animals. This information supplemented by an inspection of the animal, and of the herd from which it came, provides the breeder with sufficient information to decide upon the desirability of using the animal in his breeding program.

Carnation Milk Farm
Seattle, Wash.

1/10/52

PURE BRED HOLSTEIN-FRIESIAN

Sex: Male E. T. 9826

H. B. No.

Born: December 5, 1951

His seven nearest dams average:

Fat 365 days 832.10

Milk 22307.00

The Blue Ribbon sire is a son of the Gold Medal Proven sire, Hallrose Progressor, from an 874 lb. daughter of a 1066 lb. full sister to the three times All-American champion, Carnation Governor Imperial.

The Res. Grand Champion dam made up to 973 lbs. fat in a year and is by a Res. All-Time All-American son of "Imperial," from a daughter of a 767 lb. Sr. 4-yr-old.

CARNATION PROFESSOR
1054493

His five nearest yearly tested dams average:

Fat 365 days 959.90

Milk 24151.00

1st prize Jr. Yrlg., Pacific International, 1949.

1st prize Jr. Yrlg., Western Washington Fair, 1949.

2d prize 2-yr-old, Pacific International, 1950.

2d prize 2-yr-old, Western Washington Fair, 1950.

CARNATION MAYBESS BONNIE 2194538

Fat 365d 5y 973.00

Milk (4X-3.8%) 25509.00

Fat 365d 2y 587.90

Milk (3X) 16378.00

Res. Grand Champion, Michigan State Fair, 1941.

1st prize Sr. Calf, Michigan State Fair, 1941.

2d prize Sr. Calf, National Dairy Show, 1941.

3rd prize Sr. Calf, Waterloo, 1941.

Carnation Professor 1054493

HALLROSE PROGRESSOR "E" 808292

"Gold Medal Proven Sire"

1st prize Bull Calf, Pacific International, 1941.

18 A R daughters

2 with 852 and 936 lbs.

14 from 434 to 791 lbs.

Hallrose Black Beauty "VG"

Fat 365d 5½y 936.80

Milk (4X-3.7%) 25316.00

HALLROSE FORWARD 724996

2d prize Aged Bull, California State Fair, 1940.

3 A R daughters

2 with 653 and 701 lbs.

6 H T daughters

LOLA AAGGIE MYRETTA "E" 2024874

Fat 365d 4½y 882.00

Milk (3X-3.9%) 22538.00

Member, Reserve All-American Produce of Dam, 1940.

CARNATION KORNDYKE HEILO LASSIE 2638045

365d 4½y 3X 21314 4.1% 874.4

365d 3½y 3X 15975 4.1% 651.1

305d 3½y 3X 14494 4.1% 587.8

365d 2y 3X 15501 4.0% 620.9

CARNATION CHIEFTAIN 647922

36 A R daughters

9 from 827 to 1059 lbs.

22 from 504 to 784 lbs.

7 H T daughters

CARNATION IMPERIAL LASSIE 1972618

Fat 365d 5y 1066.80

Milk (4X-4.4%) 24372.00

3 A R daughters

From 671 to 874 lbs.

A Twin Sister to—Carnation Korn. Lassie Heilo

312d 4y 3X 17512 3.8% 671.4

A full sister to—Carnation Ensign

Res. All-American 3-yr-old bull, 1948.

Carnation Imperial Chief

"Silver Medal Type Sire"

Carnation Maybess Bonnie 2194538

CARNATION RENOWN 771562

Res. All-Time All-American Jr. Yrlg.

All-American Jr. Yrlg., 1939

36 A R daughters

7 from 736 to 973 lbs.

29 from 403 to 675 lbs.

Carnation Maybess Bonnie

Fat 365d 5y 973.00

Milk (4X-3.8%) 25509.00

19 H T daughters

CARNATION GOVERNOR IMPERIAL 698462

Three times All-American.

102 A R daughters

24 from 804 to 1107 lbs.

61 from 480 to 799 lbs.

CARNATION BESSIE WALKER MAY 1742906

Fat 365d 9y 857.40

Milk (4X) 27039.30

Fat 365d 6½y 744.90

Milk (3X) 23402.50

CARNATION BONNIE HAZELWOOD 2018967

Fat 365d 2y 404.40

Milk (3X) 12879.00

CARNATION PEERLESS 629480

44 A R daughters

12 from 803 to 1015 lbs.

15 from 500 to 777 lbs.

5 A R sons

CARNATION BONNIE MASTERPIECE 1565805

365d 4½y 4X 22498.........767.0

2d 3-yr-old, W. Wash., 1934.

SUMMARY

The reproductive cell of the female is called an ovum. The male cell is called a sperm. Each parent contributes equally in the reproduction process.

The ovum is produced in a follicle of the ovary and is dropped into the oviduct. It is fertilized by a sperm in the upper end of the oviduct. From there it moves to the uterus where it becomes attached to the wall and develops.

The sperm is produced in the testicle and moves through the sperm ducts to the urethra and penis. The seminal vesicles, prostate, and Cowper's glands add secretions to the seminal fluid.

The chromosomes in the reproductive cells carry genes which determine the characteristics to be transmitted to the progeny. Chromosomes occur in pairs, with one of each pair in the male cell uniting with one of each pair in the female cell to produce the new individual. The reproductive cell in swine has nineteen pairs of chromosomes while the germ cell of cattle, sheep, and horses has thirty pairs. The two members of a pair of chromosomes carry genes which affect the same physical conditions of the animal, but they may not affect them in the same way.

Some factors of inheritance are dominant while others are recessive. A hybrid condition exists when the germ cell has one dominant and one recessive gene. When hybrids are crossed 25 per cent of the progeny are pure dominant, 50 per cent are hybrid, and 25 per cent are recessive. Only the recessives will show the characteristics of the recessive.

Hybrid vigor is produced by crossing two unrelated breeds. The crossing of inbred lines of two or more breeds increases the heterosis, or hybrid vigor.

Pedigrees provide the ancestry of an animal and in some cases the prolificacy and productiveness. The pedigree supplemented by an inspection of the animal, and of the herd from which it came, provides the breeder with information necessary in selecting animals for a breeding program.

QUESTIONS

1. Name the reproductive organs of the male, and indicate the function of each.
2. What are the reproductive organs of the female, and what are their functions?

3. What is meant by ovulation, and when does it take place in relationship to the heat period?
4. What is the difference between a gene and a chromosome?
5. Explain the process of making and fertilizing of germ cells.
6. Which contributes most to inheritance, the ovum or the sperm? Explain.
7. Explain hybrid vigor in terms of the gene composition of the chromosomes.
8. What differences exist in the gene composition of the chromosomes in purebred and crossbred animals?
9. What information is shown on a pedigree which is of value to a man purchasing a beef bull? Explain.
10. What do we mean by an extended pedigree?

REFERENCES

Anderson, Arthur L., *Introductory Animal Husbandry*, The Macmillan Company, New York, 1951.

Ensminger, M. E., *Animal Science*, The Interstate Printers and Publishers, Danville, Illinois, 1950.

Lush, Jay L., *Animal Breeding Plans*, Collegiate Press, Incorporated, Ames, Iowa, 1937.

Stanbury, J. L., *Reproduction of Dairy Cattle*, Bulletin 294, The Ohio State University, Columbus, 1948.

Winters, Lawrence M., *An Introduction to Breeding Farm Animals*, John Wiley and Sons, Inc., New York, 1942.

Index

A

Aberdeen-Angus cattle, 183–84
Abnormalities, beef cattle, 195–96
Abomasum, function, 25–26
Acute hypoglycemia, 151
Air sac infection, poultry, 554
American class, chickens, 481
American Guernsey Cattle Club, 278
American Jersey Cattle Club, 279
American Red Danish Cattle Association, 284
American Standard of Perfection, 484
Amino acids, 4
Anemia, pigs, 112–13
Animal:
  by-products, 13
  classes affect feed value, 29
  proteins, 10
    sources, 12–13
  simple-stomach, *see* Simple-stomach animals
Anthrax:
  cattle, 368
  sheep, 451–52
Antibiotics, 6
  calves, 209, 330–31
  cattle, 233
  chickens, 509
  chicks, 522
  function, 6
  heifers, 212
  pigs on pasture, 127–30
  sources, 18–21
  turkeys, 540–41
Arsenicals:
  chicks, 522–23
  turkeys, 541
Artificial insemination, dairy cattle, 310–11
Asiatic class, chickens, 483
Atrophic rhinitis, hogs, 147–49
Auction sales:
  feeder cattle, 245–46
  feeder lambs, 456
Ayrshire Breeders Association, 282
Ayrshire cattle, 280–82

B

Babcock test, 287–88
Baby-pig disease, 151
Bacon-type hogs, 48–49, 55
Bangs, sheep, 451
Barley, source of carbohydrates, 11
Barrow, Richard, 184, 185
BDI detergent test, dairy cattle, 288–89
Bedding, market hogs, 98
Beef cattle:
  abnormalities, 195–96
  breeding, 220
  breeding herd, feeding and management, 203–21
    castration, 219
    dehorning, 216–18
    equipment, 213–15
    grain and forage to supplement grass, 204–11
    housing, 212–13
    marking, 219–20
    replacement heifers, feeding, 211–12
    summer feeding, 203–04
    winter feeding, 209–11
  breeding stock, selection, 181–82
    availability, 182
    environmental conditions, 182
    outlet for surplus animals, 182
    personal likes, 181
  breeds, 182–90
    Aberdeen-Angus, 183–84
    Brahman, 184–85
    crossbreds, 190–91
    Herefords, 185–86
    Polled Hereford, 186–87
    Polled Shorthorns, 188–89
    Santa Gertrudis, 189–90
    Shorthorns, 187–88
  deformities, 195–96
  feeder cattle, 196–201
    classes, 196–98
    equipment for fattening, 237–39
    feed efficiency factors, 236–37
    feeding and management, 223–41
    feeding systems, 224–26
    feeds for, 226–36
    grades, 198–99
    marketing, 243–47
    profits from, source, 224
    securing cattle, 223
    selecting, 199–201

Beef cattle (*Cont.*):
foundation stock, selecting, 191–95
body conformation, 192–94
production records, 194–95
marketing, 243–56
purebred, industry, 178–79
slaughter cattle:
classification and grades, 247–49
determining when to sell, factors, 253–55
losses due to damaged carcasses, 255
marketing, 249–53
Beef production, 175–256
abnormalities, 195–96
breeding herd, feeding and management, 203–21
breeding stock, selecting, 181–82
breeds, 182–90
deformities, 195–96
feeder cattle, 196–201
feeding and management, 223–41
foundation stock, selecting, 191–95
industry, 175–80
marketing beef cattle, 243–56
opportunities in, 175
producers, classes, 175–80
combining two or more enterprises, 179–80
fat or slaughter cattle, 177–78
feeders, 176–77
purebred beef cattle, 178–79
Berkshire hogs, 56
Black-faced Highland sheep, 397–98
Blackhead, poultry, 553
Blackleg, cattle, 368
Black scours, hogs, 147
Blind teat, 73
Bloat:
cattle, 375
sheep, 453
Blood meal, source of animal protein, 13
Blow flies, sheep, 444–45
Boars:
feeding and management, breeding season, 86–87
inactive, 88
nonbreeders, 88
ranty, 88
Brahman cattle, 184–85
Breeding flock, sheep:
breeding season, 411–14
age to breed, 414
conditioning the ram, 413
ewe ram ratio, 413
feet, care, 412
flushing, 411–12
Breeding flock, sheep (*Cont.*):
breeding season (*Cont.*):
heat period, 414
marking the ram, 413–14
overfat ewes, 412–13
trimming, 412
feeding and management, 411–31
lambing time, management at, 416–20
lambs, feeding and management, 420–29
castrating, 420–22
docking, 422–23
weaning, 428–29
pregnant ewes, feeding and management, 414–16
Breeding herd, beef cattle, feeding and management, 203–21
castration, 219
dehorning, 216–18
equipment, 213–15
grain and forage to supplement grass, 204–11
housing, 212–13
marking, 219–20
replacement heifers, feeding, 211–12
summer feeding, 203–04
winter feeding, 209–11
Breeding herd, hogs, feeding and management, 82–94
Breeding season, pork production, 83–89
age to breed, 83–84
boar, feeding and management, 86–87
breeding and farrowing dates, 84
feeding and care during, 83–89
flushing, 86
gestation period, 84
feeding and care during, 89–93
heat period, 84
one-litter system, 85–86
pen- versus lot-breeding, 87–88
ranty and inactive boars, 88
records, 88
time to breed, 84–85
two-litter system, 85–86
Breeding stock, selecting:
beef cattle, 181–82
availability, 182
environmental conditions, 182
outlet for surplus animals, 182
personal likes, 181
dairy cattle, 271–72
factors in, 271–72
parts of a cow, 272
dual-purpose cattle, selection, 354–55
hogs, selecting, 45–80

Breeding stock, selecting (*Cont.*):
hogs, selecting (*Cont.*):
systems, 49–54
sheep, cost and availability, 399–400
Breeds:
beef cattle, 182–90
Aberdeen-Angus, 183–84
Brahman, 184–85
crossbreds, 190–91
Herefords, 185–86
Polled Hereford, 186–87
Polled Shorthorns, 188–89
Santa Gertrudis, 189–90
Shorthorns, 187–88
chickens, 483–86
dairy cattle, 273–85
Ayrshire, 278–80
Brown Swiss, 282–84
Dutch Belted, 284–85
Guernsey, 276–78
Holstein-Friesian, 273–76
Jersey, 278–80
Red Danish, 284
dual-purpose cattle, 352–54
Devon or Ruby Reds, 354
Milking Shorthorns, 352–53
Red Poll, 353–54
selecting, 352
hogs, 54–68
Berkshire, 56
characteristics, 56–68
Chester White, 56–57
classification, 55–56
Danish Landrace, 57–58
Duroc, 58–59
Hampshire, 59–60
Hereford, 61
Minnesota No. I, 64, 65–68
new, developed from inbred lines, 65–68
OIC, 61–62
origin, 56–68
Poland China, 62–63
selection, factors, 55
Spotted Poland China, 63
Tamworth, 63–64
Yorkshire, 64–65
sheep:
Black-faced Highland, 397–98
carpet-wool, 397–98
Cheviot, 390–91
Columbia, 397
Corriedale, 397
Cotswold, 395
crossbred-wool, 397
Dorset, 391
fine-wool, 387–89
fur sheep, 398
Breeds (*Cont.*):
sheep (*Cont.*):
Hampshire, 391–92
Karakul, 398
Leicester, 395
Lincoln, 395–96
long-wool, 395–96
medium-wool, 390–95
Merinos, 387–89
Montadale, 392
Oxford, 392
Panama, 397
Rambouillet, 389–90
Romeldale, 397
Romney, 396
selecting, 398–400
Shropshire, 392
Southdown, 392
Suffolk, 392
Targhee, 397
Tunis, 394–95
Broad tapeworm, sheep, 447–48
Broilers:
production, 527–28
trends in poultry production, 471
turkey, 542
Bronchitis, poultry, 546–47
Brooder houses:
chickens, 516–18
turkeys, 534
Brooders:
kinds, 518–19
market hogs, 99–101
turkey, 534–35
Brown Swiss cattle, 282–84
Brown Swiss Cattle Breeders Association, 284
Brucellosis:
cattle, 365–67
hogs, 149
sheep, 451
Bulls, dairy:
age for service, 321
feeding and management, 319–21
housing and yard, 320
ringing, 321
selecting, 293–94
trimming feet, 321
Bunks, sheep, 430
Butter:
price trends, seasonal, 335–37
production, 263–64
Butterfat feed price ratios, 336–37
Buttermilk, source of animal protein, 13
By-products:
animal, source of animal protein, 13
dairy, source of animal protein, 13

By-products (*Cont.*):
seed, source of vegetable protein, 14–15

C

Calf scours, 373–74
Calves:
care, 325–27
creep-feeding, 208–09
dehorning, 332
feeding from four days to six months, 327–31
management practices, 331–32
marking, 332
pens, 331–32
suckling:
antibiotics for, 209
feeding, 208–09
teats, removal of extra, 332
Cannibalism:
chickens, 510–11
chicks, 525–26
turkeys, 541
Caponettes, 528–29
Capons, 529
Carbohydrates:
chickens, 507
chicks, 521
composition, 4
function, 3
measures of feed value, 30
sources, 10–12
Carpet wool, 464
Carpet-wool type sheep, 387, 397–98
Castration:
beef cattle, 219
lambs, 420–22
pigs, 113–14
Catron, Dr. Damon, 18, 127
Cattle:
beef, *see* Beef cattle
dairy, *see* Dairy cattle
diseases:
anthrax, 368
blackleg, 368
bloat, 375
brucellosis, 365–67
calf scours, 373–74
foot-and-mouth disease, 372
foot rot, 369
infectious, 365–74
ketosis, 376
mastitis, 370–71
milk fever, 374–75
noninfectious, 374–76
pink eye, 370
poisonous plants, 376
ringworm, 374

Cattle (*Cont.*):
diseases (*Cont.*):
shipping fever, 369
tuberculosis, 367–68
warts, 373
X disease, 372–73
dual-purpose, *see* Dual-purpose cattle
feeder, *see* Feeder cattle
parasites:
common stomach worms, 364–65
external, 360–64
grubs, 361–62
horn flies, 362–63
internal, 364–65
lice, 362
mites, 364
screw worms, 360–61
stable flies, 363–64
ticks, 364
sanitation program, 359–60
slaughter, *see* Slaughter cattle
spraying, 363–64
Cecal worms, poultry, 554–55
Chemicals, dehorning, 217
Chester White hogs, 56–57
Chester White Swine Record Association, 57
Cheviot sheep, 390–91
Chickens:
breed, selecting, 480–86
breeds and varieties, 483–86
broiler production, 527–28
cannibalism, 511–12
caponettes, 528–29
capons, 529
chicks, *see* Chicks
classes, 480–83
crossbred, 484
culling the flock, 489–95
diseases, *see* Poultry, diseases
feeding systems, 509–10
feeds, 506–09
antibiotics, 509
carbohydrates, 507
fats, 507
fibers, 508
minerals, 508–09
proteins, 507–08
vitamins, 509
water, 509
good layers, selecting, 491–95
housing, 499–506
dropping pits, 500
feeders, 503
laying houses, types, 505–06
nests, 501–02
roosts, 499–500
space required, 499

Chickens (*Cont.*):
housing (*Cont.*):
ventilation, 503–04
watering equipment, 502–03
hybrid, 484
laying flock, feeding and management, 497–515
moving pullets to laying house, 498–99
profits, increasing, 497–98
market classes, 565
parasites, *see* Poultry, parasites
pullets, *see* Pullets
range for, 526
rations, 510–11
records, 512–13, 529
separate cockerels from pullets, 526
trends in poultry production, 470–71
Chicks:
brooder houses, 516–18
brooder management, 519
brooders, kinds, 518–19
buying, 486–89
cannibalism, 525–26
culling, 490
feeders, 519–20
feeding and management, 516–31
feeds, 520–23
antibiotics, 522
arsenicals, 522–23
carbohydrates, 521
fats, 521
minerals, 521
proteins, 520
surfactants, 523
vitamins, 521–22
litter, 518
range shelters, 524–25
rations for, 523–24
roosts, 525
waterers, 519–20
Cholera:
fowl, 551–52
hog, 142–43
Chromosomes, 583
Chromosome segregation, 584
Classes:
chickens, 480–83
eggs, 560–63
feeder cattle, 196–98
feeder sheep, 406
sheep, 386–87
slaughter cattle, 247–49
slaughter sheep, 458–59
Cleaning:
cows, 311–12, 345–46
milking machines, 343–45
utensils, 343
Clippers, dehorning, 218
Closed formula, feed analysis tags, 33
Clothing wool, 464
Coccidiosis:
poultry, 545–46
sheep, 449–50
Columbia sheep, 397
Combing wool, 464
Commercial mixed feeds:
feed analysis tags, 33–34
closed formula, 33
open formula, 34
feed value, 33–34
Concentrates, 9–10
average composition of common, table, 19
calf feeding, 329–30
cattle on grass, 236
dairy cattle, 303–05
feeder cattle, 243–44
protein:
average composition of common, table, 19
minerals in, 18
Cooling facilities, milk, 341, 342–43
Cooperative marketing, slaughter cattle, 253
Corn, source of carbohydrates, 10–11
Corn gluten meal, source of vegetable protein, 15
Corriedale sheep, 397
Cotswold sheep, 395
Cottonseed meal and cake, source of vegetable protein, 14
Cowper's glands, 583
Creep-feeding:
calves, 208–09
young pigs, 107–08
Criss-crossing, pork production, 52–53
Crop function, 27
Crossbred-wool type sheep, 387, 397
Crossbreeding, pork production, 50–52
Crossline breeding, pork production, 54
Crude fiber, 7

D

Dairy by-products, source of animal protein, 13
Dairy cattle:
age to breed, 309–10
artificial insemination, 310–11
breeding stock, selection, 271–72
breeds, 273–85
Ayrshire, 280–82
Brown Swiss, 282–84
Dutch Belted, 284–85
Guernsey, 276–78

Dairy cattle (*Cont.*):
breeds (*Cont.*):
Holstein-Friesian, 273–76
Jersey, 278–80
Red Danish, 284
bulls:
feeding and management, 319–21
selecting, 293–94
calves:
care, 325–27
feeding from four days to six months, 327–31
management practices, 330–31
cleaning the cows, 311–12, 345–46
Dairy Cow Score Card, 290–93
dairy herd management, 309–13
drying-off cows, 308–09
feeding, 302–08
dry and fresh cow, 308–09
feeds for, 297–302
dry roughages, 297–99, 302–03
grains, 299–300
minerals, 302
proteins, 300–01
vitamins, 301
water, 302
gestation period, 311
heat periods, 311
housing, 313–19
insulation, 314–16
loose housing system, 317–19
stanchion barn, 313–17
temperature, 317
ventilation, 316–17
maternity pen, 325
milking the cows, 312–13, 346
parts of a cow, 272
pedigree, 285
physical appearance, 289–93
production records, 285–89
testing the home herd, 286–89
Babcock test, 287–88
BDI detergent test, 288–89
owner-sampling test, 286
time to breed, 310
young stock, feeding and management, 325–33
Dairy Cow Score Card, 290–93
Dairy Herd Improvement Association, 271–72
Dairying:
advantages, 265–66
disadvantages, 266–67
Dairy products:
consumption, 259–61
industry, 259–70
marketing, 334–48
markets available, 338–39
Dairy products (*Cont.*):
milk:
forms in which sold, 337–38
Grade A, 339–46
utilization, 261
price trends, seasonal, 334–37
butterfat feed price ratios, 336–37
butter prices, 335
milk prices, 334–35
production, 261–64
factors in profitable, 267–68
profit, methods of increasing, 268–69
quality, improving, 339–46
source of animal protein, 13
Danish Landrace hogs, 57–58
Deformities, beef cattle, 195–96
Dehorning, 216–18, 332
Delaine Merinos, 387–88
Devon cattle, 354
Digestible nutrients, 7
Digestion:
poultry, 26–27
ruminants, 24–26
simple-stomach animals, 26
Diseases:
cattle:
anthrax, 368
blackleg, 368
bloat, 375
brucellosis, 365–67
calf scours, 373–74
foot-and-mouth disease, 372
foot rot, 369–70
infectious, 365–74
ketosis, 376
mastitis, 370–71
milk fever, 374–75
noninfectious, 374–76
pink eye, 370
poisonous plants, 376
ringworm, 374
shipping fever, 369
tuberculosis, 367–68
warts, 373
X disease, 372–73
hogs, 142–152
anemia, 112–13
atrophic rhinitis, 147–49
baby-pig disease, 151
black scours, 147
brucellosis, 149
erysipelas, 144–46
flu, 150–51
hog cholera, 143–44
necrotic enteritis (necro), 146–47
prevention, 142–43
transmissible gastroenteritis, 151–52

Diseases (*Cont.*):
hogs (*Cont.*):
vesicular exanthema, 150
poultry, 544–54
air sac infection, 554
blackhead, 553
bronchitis, 546–47
cholera, 551–52
coccidiosis, 545–46
fowl pox, 550
infectious sinusitis, 553–54
laryngotracheitis, 547–48
Newcastle disease, 548–49
pullorum, 544–45
range paralysis, 549
roup, 550–51
tuberculosis, 552
typhoid, 551
sheep:
anthrax, 451–52
bloat, 453
brucellosis, 451
foot and mouth disease, 452
foot rot, 452
infectious, 450–53
lamb dysentery, 452–53
overeating disease, 450–51
pregnancy disease, 453
sore mouth, 450
stiff lamb disease, 453
tuberculosis, 451
Disposition, breeding stock selection factor, 76
Docking, 422–23
Dominant character, 583–84
Dorset sheep, 391
Dressing percentage, lambs, 460–61
Dried skim milk, source of animal protein, 13
Dropping pits, 500
Drying-off cows, 308–09
Dry-lot:
fattening in, feeder cattle, 225
pigs on, feeding and management, 136–38
feeding floors, 137–38
summer and fall pigs, 137
Dual-purpose cattle:
adaptability, 351–52
breeding stock, selection, 354–55
breeds, 352–54
Devon or Ruby Reds, 354
Milking Shorthorns, 352–53
Red Poll, 353–54
selecting, 352
Ducks, market classes, 566
Duroc hogs, 58–59
Dutch Belted, 284–85
Dwarfism, beef cattle, 195–96

E

Ear-notching, market hogs, 104–05
Eggs:
classes and grades, 560–63
consumption, 475
income from, 469–70
marketing, 558–64
quality, maintaining, 563–64
trends in, 472–73
Elastrator, castrating with, 422
Emasculator, castrating with, 421–22
English class, chickens, 482
Equipment:
breeding herd, 213–15
dairy cows, 313–19
fattening cattle, for, 237–39
lamb feeding, 438
sheep, for, 429–30
watering, chickens, 502–03
Erysipelas, hogs, 144–46
Ewes:
age to breed, 414
care immediately after lambing, 420
heat period, 414
lambing time, management at, 416–20
overfat, 412–13
pregnant, feeding and management, 414–16
preparing for lambing, 418–19

F

Farrowing stalls, 101–02
Farrowing time, market hogs, care and management, 95–105
assistance at, 102–03
bedding, 98
brooders, 99–101
ear-notching, 104–05
farrowing stalls, 101–02
feeding and management, 102–04
guard rails, 99
heat lamps, 99–101
housing, 96–102
navel cord, 103
needle teeth, 103–04
rations at, 102
sanitation, 97–98
Fats:
chickens, 507
chicks, 521
composition, 4
function, 3
measures of feed value, 30
Feed analysis tags, 33–34
closed formula, 33
open formula, 34

Feed bunks, 214, 438
Feeder cattle, 196–201
  classes, 196–98
  equipment for fattening, 237–39
  feeding and management, 223–41
  feed efficiency factors, 236–37
  feeding systems, 224–26
  feeds for, 226–36
    antibiotics, 233
    concentrate for cattle on grass, 236
    gains on grass, factors influencing, 236
    grains, 229–30
    pastures, 235–36
    proteins, 230–33
    rations, 233–35
    roughages, 226–28
  grades, 198–99
  marketing, 243–47
  profits from, source, 224
  securing, 223
  selecting, 199–201
Feeder lambs, 433–34
  equipment for feeding, 438
  fattening, 434–37
    feed requirements per hundred weight gain, 437
    grains, 435
    hormones, 437
    proteins, 435–36
    roughages, 435
    self-feeding versus hand-feeding, 436–37
  feed lot troubles, 438–39
  kind to buy, 433–34
  marketing, 455–58
  profit, sources, 434
  where to buy, 434
Feeder pigs, 76–79
  hatcheries, 77–78
  selection, 78–79
Feeders:
  chickens, 503
  chicks, 519–20
  turkey, 538
Feeder sheep:
  classes, 406
  grades, 406
  selection, 405–07
Feeding floors, dry-lot feeding, 137–38
Feed racks, sheep, 430
Feeds:
  animal proteins, sources, 12–13
  antibiotics, 6
    sources, 18–21
  carbohydrates, sources, 10–12
  chickens, 506–09
  chicks, 520–23
Feeds (*Cont.*):
  classification, 9–22
  commercial mixed, feed value, 33–34
  composition, 9–22
  concentrates, 9–10
  dairy cattle, 297–302
  efficiency factors, 236–37
  farm-produced, minerals in, 17–18
  feeder cattle, 226–36
  minerals, sources, 17–18
  nutrient, 3–6
  nutrient values, 22
  quality, 31–33
    factors affecting, 31–32
    ration balancing, 32–33
  roughages, 9, 12
  turkeys, 539–41
  value, *see* Feed value
  vegetable protein, sources, 14–15
  vitamins, sources, 15–17
Feed storage equipment, 215
Feed value:
  carbohydrates as measures, 30
  classes, of animals affect, 29
  commercial mixed feeds, 33–34
  fats as measures, 30
  measuring, 29–34
  mineral content as measure, 31
  nutrients, digestible, determining in terms of, 29–31
  proteins as measures, 30–31
  quality of feeds, 31–33
    factors affecting, 31–32
    ration balancing, 32–33
  vitamins as measures, 31
Female reproductive organs, 581–82
Fiber, 7, 508
Fine-wool type sheep, 386, 387–89
Fish meal, source of animal protein, 13
Fleece:
  reject, 461–62
  shrinkage, 464
Flu, hog, 150–51
Flue ventilation, laying house, 505
Flushing, 86, 411–12
Foot-and-mouth disease:
  cattle, 372
  sheep, 452
Foot rot:
  cattle, 369–70
  sheep, 452
Fowl cholera, 551–52
Fowl pox, 550
French combing wool, 464
Frost, J. M., 184
Fur sheep, 387, 398

G

Gammon, Warren, 186
Garbage feeding, market hogs, 139
Geese, market classes, 566
Genes, 583
Gestation period:
  dairy cows, 311
  hogs, 84
    feeding and care during, 89–93
Gid tapeworm, sheep, 448
Gizzard, function, 27
Grades:
  eggs, 560–63
  feeder cattle, 198–99
  feeder sheep, 406
  hogs, 163–66
  slaughter cattle, 247–49
  slaughter sheep, 458–59
Grading, 585
Grains:
  calf feeding, 329
  dairy cattle, 299–300
  fattening cattle, 229–30
  fattening lambs, 435
  source of carbohydrates, 10–12
Grain sorghums, source of carbohydrates, 12
Grasses, average composition of pasture, 21
Grease wool, 464
Grub in the head, sheep, 449
Grubs, 361–62
Guard rails, market hogs, 99
Guernsey cattle, 276–78
Guineas, market classes, 566

H

Hampshire:
  hogs, 59–60
  sheep, 391–92
Hatcheries, pig, 77–78
Hayracks, 213, 438
Health:
  breeding stock selection factor, 76
  feeder pig selection factor, 79
Heat lamps, market hogs, 99–101
Heat period:
  dairy cows, 311
  ewes, 414
  hogs, 84
Heifers:
  antibiotics for growing, 212
  replacement, feeding, 211–12
Hereford:
  beef cattle, 185–86
  hogs, 61
Heterosis, 584–85
Hog cholera, 142–43
Hogging down corn, 138–39
Hogs:
  age, selection factor, 74
  bacon-type, 48–49
  breeding season, feeding and care during, 83–89
  breeding stock:
    ideal type, 72–74
    selecting, other factors in, 74–76
  breeding systems, 49–54
    criss-crossing, 52–53
    crossbreeding, 50–52
    crossline, 54
    inbreeding, 53–54
    line, 54
    purebred, 49–50
    rotation, 53
    upgrading, 49
  breeds, 54–68
    Berkshire, 56
    characteristics, 56–68
    Chester White, 56–57
    classification, 55–56
    Danish Landrace, 57–58
    Duroc, 58–59
    Hampshire, 59–60
    Hereford, 61
    Minnesota No. I, 64, 65–68
    new, developed from inbred lines, 65–68
    OIC, 61–62
    origin, 56–58
    Poland China, 62–63
    selection, factors, 55
    Spotted Poland China, 63
    Tamworth, 63–64
    Yorkshire, 64–65
  diseases, 142–52
    anemia, 112–13
    atrophic rhinitis, 147–49
    baby-pig disease, 151
    black scours, 147
    brucellosis, 149
    erysipelas, 144–46
    flu, 150–51
    hog cholera, 143–44
    necrotic enteritis (necro), 146–47
    prevention, 142–43
    transmissible gastroenteritis, 151–52
    vesicular exanthema, 150
  disposition, selection factor, 76
  feeder pigs, 76–79
    hatcheries, 77–78
    selection, 78–79
  feeding stock, selecting, 46–80
  gestation period, feeding and care during, 89–93
  health, selection factor, 76

Hogs (*Cont.*):
market, *see* Market hogs
market, ideal type, 69–72
marketing, 158–71
care in, 169–70
changes in hog market, 159–60
choosing a market, 168–69
grades, 163–66
market classes, 163–66
selling according to carcass, weight and grade, 167–68
shipping pointers, 170
time to sell, 160–61
weight to sell, 162–63
meat-type, 47–48, 55, 160
parasites, 152–56
lice, 156
lungworms, 154
mange, 154–56
roundworms, 152–54
parts of, 68, 69
pedigree, selection factor, 74–75
performance records, selection factor, 75–76
production, advantages, 41–42
production records, selection factor, 75–76
selection of individual boars and sows, 69–79
types, 46–49
bacon-type, 55
meat-type, 47–48, 55, 160
Hog wallows, 136
Holstein-Friesian cattle, 273–76
Hormones:
feeder lambs, 437
inducing ewes to breed, 414
Horn flies, 362–63
Hot iron, dehorning, 217
Housing:
breeding herd, beef cattle, 212–13
dairy bull, 320
dairy cattle, 313–19
loose housing system, 317–19
laying flock, chickens, 499–506
market hogs, 96–98
gestation period, 92–93
sheep, 430
Hybrid, 584
Hybrid vigor, 584–85

I

Ice cream production, 264
Inbreeding, 586
pork production, 53–54
Infectious sinusitis, poultry, 553–54
Inheritance, laws, 583–86
chromosomes, 583

Inheritance, laws (*Cont.*):
chromosome segregation, 584
dominant character, 583–84
genes, 583
grading, 585
hybrid vigor, 584–85
inbreeding, 586
linebreeding, 586
pure breeding, 585
recessive character, 583–84
Intestinal worms, sheep, 447

J

Jersey cattle, 278–80

K

Karakul sheep, 398
Ketosis, cattle, 376
Knife:
castrating with, 421
docking with, 423

L

Lamb dysentery, 452–53
Lambs:
castrating, 420–22
chilled, 419
delivering, 419
disowned, 419–20
docking, 422–23
fattening, 434–37
feeder, *see* Feeder lambs
feeding, 423–26
feeding and management, 420–29
lambing time, management at, 416–20
newborn, care, 419
orphaned, 419–20
pinning, 420
shearer, 406
slaughter, marketing, 458–59
weaning, 428–29
weight to buy, 407
Lard:
consumption, 39–40
problem, 41–42, 159–60
Laryngotracheitis, poultry, 547–48
Laying houses, types, 505–06
Legume roughages, 9
source of vegetable protein, 15
Legumes, average composition of pasture, table, 21
Leicester sheep, 395
Lice:
cattle, 362
hogs, 156
poultry, 555
sheep, 442–43
Lights, poults, 536

Lincoln sheep, 395–96
Line breeding, 586
Line breeding, pork production, 54
Linseed meal, source of vegetable protein, 14
Litter:
  chicks, 518
  laying house, 500–501
  turkeys, 534
Livestock Registry Association, 68
Long-wool type sheep, 387, 395–96
Loose housing system, dairy cows, 317–19
Lot-breeding, 87–88
Lungworms:
  hogs, 154
  sheep, 448–49

M

Male reproductive organs, 583
Malta fever, hogs, 149
Mange, hogs, 154–56
Margin, 177–78, 224
Market classes of hogs, 163–66
Market hogs:
  dry lot, pigs on, feeding and management, 136–38
    feeding floors, 137–38
    summer and fall pigs, 137
  farrowing time, care and management at, 95–105
    assistance at, 102–03
    bedding, 98
    brooders, 99–101
    ear-notching, 104–05
    farrowing stalls, 101–02
    feeding and management, 102–04
    guard rails, 99
    heat lamps, 99–101
    housing, 96–102
    navel cord, 103
    needle teeth, 103–04
    rations at, 102
    sanitation, 97–98
  feeding and management, 95–141
  feeding pigs on pasture, 120–36
    antibiotics, 127–30
    hog wallows, 136
    methods, 120–22
    minerals, 131–32
    proteins, 123–27
    rations, 122–23
    rations for growing and fattening, complete, 132–33
    self-feeders, 122
    shade, 135
    vitamins, 130–31
    water, 134
Market hogs (*Cont.*):
  garbage feeding, 139
  hogging down corn, 138–39
  pastures, 118–20
  suckling period, management during, 106–16
    anemia, 112–13
    castration, 113–14
    feeding, 106–12
    pasture, 115
    vaccination, 114–15
    weaning, 115
    weighing pigs at fifty-six days, 116
  weaning to market, management from, 116–39
  worming, 117–18
Marketing:
  beef cattle, 243–56
  cooperative, slaughter cattle, 253
  dairy products, 334–48
    markets available, 338–39
    milk, forms in which sold, 337–38
    price trends, seasonal, 334–37
    quality, improving, 339–46
  eggs, 558–64
  feeder cattle, 243–47
  feeder lambs, 455–58
  hogs, 158–71
    care in, 169–70
    changes in hog market, 159–60
    choosing a market, 168–69
    grades, 163–66
    market classes, 163–66
    seasonal price variations, 161
    selling according to carcass, weight and grade, 167–68
    shipping pointers, 170
    time to sell, 160–61
    weight to sell, 162–63
  poultry, 564–65
    dressed, 568–76
    live, 566–67
    ready-to-cook, 568–76
  slaughter cattle, 249–53
    determining when to sell, factors, 253–55
    losses due to damaged carcasses, 255
  slaughter lambs and sheep, 458–59
  wool, 461–65
Marking:
  beef cattle, 219–20
  calves, 332
  ram, 413–14
Mastitis, cattle, 370–71
Mattingly, E. H., 392
Meat and bone scraps, source of animal protein, 13

Meat-type hog, 47–48, 55, 160
cost of producing, 160
marketing changes, 160
Mediterranean class, chickens, 481–82
Medium-wool type sheep, 386–87, 390–95
Merinos, 387–89
Milk:
cooling facilities, 341, 342–43
forms in which sold, 337–38
Grade A, 339–46
cost of changing to, 346
definition, 339–40
producing, 341–46
requirements, 340–41
price trends, seasonal, 334–35
production per cow, average, 263
utensils, 343
utilization, 261
Milk fever, cattle, 374–75
Milk house, 342
Milking machines, cleaning, 343–45
Milking Shorthorns, 352–53
Milking the cows, 312–13, 346
Mineral feeders, 214
Minerals:
chickens, 508–09
chicks, 521
dairy cattle, 302
essential, 5
feeding pigs on pasture, 131–32
function, 5
in farm-produced feeds, 17–18
in protein concentrates, 18
measure of feed value, 31
sources, 17–18
supplement on grass, 204
supplements, sources, 18
Minnesota No. I, origin and characteristics, 64, 65–68
Mites:
cattle, 364
poultry, 555
sheep, 443–44
Molasses, source of carbohydrates, 12
Montadale sheep, 392
Montgomery, Albert, 184

N

National Hereford Hog Association, 61
National Spotted Poland China Record Association, 63
Navel cord, market hogs, 103
Necrotic enteritis (necro), hogs, 146–47
Needle teeth, market hogs, 103–04
Nests, 501–02
Newcastle disease, poultry, 548–49
Nitrogen-free extract, 7
Nonlegume roughages, 9
Nurse cow method, 329
Nutrients, 3–6
classes, 3–6
defined, 3
digestible, 7
feed value in terms of digestible, determining, 29–31
functions, 3–6
values of livestock feeds, 22

O

Oats, source of carbohydrates, 11
OIC (Ohio Improved Chesters), 61–62
OIC Swine Breeders Association, 61
Omasum, function, 25
One-litter system, breeding, 85–86
Open formula, feed analysis tags, 34
Ovaries, 581–82
Overeating disease, sheep, 450–51
Oviducts, 582
Owner-sampling testing, dairy cattle, 286
Oxford sheep, 392

P

Panama sheep, 397
Parasites:
cattle:
common stomach worms, 364–65
external, 360–64
grubs, 361–62
horn flies, 362–63
internal, 364–65
lice, 362
mites, 364
screw worms, 360–61
stable flies, 363–64
ticks, 364
hogs, 152–56
lice, 156
lungworms, 154
mange, 154–56
roundworms, 152–54
poultry, 555–56
cecal worms, 554–55
large roundworms, 554
lice, 555
mites, 555
sheep:
blow flies, 444–45
broad tapeworm, 447–48
coccidiosis, 449–50
external, 442–45
gid tapeworm, 448
grub in the head, 449

Parasites (*Cont.*):
sheep (*Cont.*):
internal, 445–50
intestinal worms, 447
lice, 442–43
lungworms, 448–49
mites, 443–44
screw worms, 444
stomach worms, 445–47
ticks, 442–43
Pastures:
beef cattle, compared, 205–08
calves, 330
dairy cattle, 299, 306–08
feeding pigs on, 120–36
antibiotics, 127–30
gestation period, 93
hog wallows, 136
methods, 120–22
minerals, 131–32
proteins, 123–27
rations, 122–23
rations for growing and fattening, complete, 132–33
self-feeders, 122
shade, 135
suckling period, pigs, 115
vitamins, 130–31
water, 134
feeder cattle, 224–25, 235–36
sheep, 426–27
swine, 118–20
kinds, 119–20
management, 120
produce better carcasses, 118–19
save feed, 118
turkeys, 537
Peanut oil meal, source of vegetable protein, 14–15
Pedigrees:
breeding stock selection factor, 74–75
dairy cattle, 285
value in animal breeding, 586–88
Pen-breeding, 87–88
Penis, 583
Pens, calves, 331–32
Performance records, breeding stock selection factor, 75–76
Pigeons, market classes, 566
Pigs, *see* Hogs
Pincers, castrating with, 421–22
Pink eye, cattle, 370
Pinning, 420
Poisonous plants, cattle, 376
Poland China hogs, 62–63
Polled Hereford, 186–87
Polled Shorthorns, 188–89
Pork production, 39–44
advantages, 41–42
breeding season, feeding and care during, 83–89
breeding stock, selection, 46–80
breeding systems, 49–54
criss-crossing, 52–53
crossbreeding, 50–52
crossline, 54
inbreeding, 53–54
line, 54
purebred, 49–50
rotation, 53
upgrading, 49
breeds, 54–68
characteristics, 56–68
classification, 55–56
origin, 56–68
selection, factors, 55
consumption, 39–40
diseases, control, 142–52
efficiency in, 42–43
feeder pigs, 76–79
gestation period, feeding and care during, 89–93
lard:
consumption, 39–40
problem, 41–42
market hogs, feeding and management, 95–141
farrowing time, care and management, 95–105
suckling period, management during, 106–16
marketing hogs, 158–71
care in, 169–70
changes in hog market, 159–60
choosing a market, 168–69
grades of hogs, 163–66
market classes, 163–66
selling according to carcass, weight and grade, 167–68
time to sell, 160–61
weight to sell, 162–63
parasites, control, 152–56
selection:
breeding animal, ideal type, 72–76
individual boars and sows, 69–79
market hog, ideal type, 69–72
types of hogs, 46–49
bacon-type, 48–49
meat-type, 47–48
weaning to market, management of pigs from, 116–39
Poultry:
chickens:
breed, selecting, 480–86
breeds and varieties, 483–86

Poultry (*Cont.*):
chickens (*Cont.*):
cannibalism, 511–12
chicks, *see* Chicks
classes, 480–83
culling the flock, 489–95
feeding systems, 509–10
feeds, 506–09
housing the laying flock, 499–506
laying flock, feeding and management, 497–515
profits, increasing, 497–98
rations, 510–11
records, 512–13
digestion in, 26–27
digestive organs, functions, 27
diseases, 544–54
air sac infection, 554
blackhead, 553
bronchitis, 546–47
cholera, 551–52
coccidiosis, 545–46
fowl pox, 550
infectious sinusitis, 553–54
laryngotracheitis, 547–48
Newcastle disease, 548–49
pullorum, 544–45
range paralysis, 549
roup, 550–51
tuberculosis, 552
typhoid, 551
dressed, marketing, 568–76
farming, advantages, 475–76
farms, specialized, 475
finishing for market, 566–67
income from, 469–70
live:
marketing, 566–67
standards of quality for, 567
market classes, 565–66
marketing, 564–65
dressed, 568–76
live, 566–67
ready-to-cook, 568–76
meat-type, improved, 571–76
parasites, 554–55
cecal worms, 554–55
large roundworms, 554
lice, 555
mites, 555
production:
industry, 469–78
opportunities in, 474–77
problems in, 476–77
trends in, 470–73
products:
consumption, 473–74
marketing, 558–78

Poultry (*Cont.*):
ready-to-cook, marketing, 568–76
turkeys:
broiler production, 542
brooding, 534–36
feeds, 539–41
finishing for market, 541–42
poults, *see* Poults
production and management, 532–43
range management, 537–41
rations, 539
selection of variety, 532–33
Poults:
brooder, 534–35
brooder house, 534
brooding, 534–36
lights, 536
ration, 536
roosts, 536
selection, 532–34
starting, 535–36
sun porch, 536
time to start, 534
waterers, 536
Pregnancy disease, sheep, 453
Pregnancy period, hogs, 84
Production records:
breeding stock selection factor, 75–76
dairy cattle, 285–89
dual-purpose cattle, 355
sheep foundation stock selection, 404
Profits:
dairy, methods of increasing, 268–69
increasing, chickens, 497–98
Prostate, 583
Proteins:
animal, 10
sources, 12–13
chickens, 507–08
chicks, 520
composition, 4
concentrates, 10
dairy cattle, 300–01
feeding pigs on pasture, 123–27
for fattening cattle, 230–33
functions, 4
lambs, 435–36
measures of feed value, 30–31
supplement on grass, 204–05
vegetable, 10
sources, 14–15
Proventriculus, function, 27
Pullets:
culling, 490
moving to laying house, 498–99
separate cockerels from, 526

Pullorum, poultry, 544–45
Purebred breeding, pork production, 49–50
Purebred Dairy Cattle Association, 290
Pure breeding, 585

Q

Quality of feeds, 31–33
  factors affecting, 31–32
  ration balancing, 32–33

R

Ram:
  conditioning, 413
  marking, 413–14
  trimming sheath, 412
Rambouillet, 389–90
Range:
  chickens, 526
  turkeys, 537–41
Range paralysis, poultry, 549
Range shelters:
  chicks, 524–25
  turkeys, 537–38
Rations:
  balanced, 7
  balancing improves digestibility, 32–33
  boar, 87
  bred sows and gilts, 90, 91
  broiler, 527–28
  chickens, 510–11
  chicks, 523–24
  complete, for growing and fattening hogs, 132–33
  dry and fresh cow, 308–09
  farrowing time, market hogs, 102
  fattening cattle, 233–35
  feeding pigs on pasture, 122–23
  flushing, for, 412
  pig starters, 109–10
  poults, 536
  turkeys, 539
  wintering feeder cattle, 235
Recessive character, 583–84
Records:
  breeding, 88–89
  chickens, 512–13, 529
  performance, breeding stock selection factor, 75–76
  production, *see* Production records
Red Danish cattle, 284
Red Poll cattle, 353–54
Reproduction, 581–83
  female reproductive organs, 581–82
  male reproductive organs, 583
Reticulum, function, 25
Ringing the bull, 321
Ringworm, cattle, 374
Romeldale sheep, 397
Romney sheep, 396
Roosts, 499–500
  chicks, 525
  poults, 536
Rotation breeding, pork production, 53
Roughages, 9
  average composition of common dry, table, 20
  calf feeding, 330
  cured, for fattening cattle, 226–28
  dairy cattle, 297–99, 302–03
  fattening lambs, for, 435
  legume, source of vegetable protein, 15
  source of carbohydrates, 12
Roundworms:
  hogs, 152–54
  poultry, 554
Roup, poultry, 550–51
Ruby Reds, 354
Rudimentaries, 73
Rumen, function, 24–25
Ruminants, 4
  digestion in, 24–26
  stomach compartments, 24
Rye, source of carbohydrates, 11–12

S

Sanitation, program for:
  cattle, 359–60
  market hogs, 97–98
  sheep, 441–42
Santa Gertrudis, 189–90
Saws, dehorning, 218
Scab of barley, 11
Screw worms:
  cattle, 360–61
  sheep, 444
Seed by-products, source of vegetable protein, 14–15
Seminal vesicles, 583
Shade, pigs on pasture, 135
Shearing sheep, 427–28
Sheep:
  breeding flock, feeding and management, 411–31
    age to breed, 414
    breeding season, 411–14
    conditioning the ram, 413
    ewe ram ratio, 413
    feet, care, 412
    flushing, 411–12
    heat period, 414
    lambing time, management at, 416–20

Sheep (*Cont.*):
breeding flock (*Cont.*):
lambs, feeding and management, 420–29
marking the ram, 413–14
overfat ewes, 412–13
pregnant ewes, feeding and management, 414–16
trimming, 412
breeding stock, cost and availability, 399–400
breeds:
Black-faced Highland, 397–98
carpet-wool, 397–98
Cheviot, 390–91
Columbia, 397
Corriedale, 397
Cotswold, 395
crossbred-wool, 397
Dorset, 391
fine-wool, 387–89
fur sheep, 398
Hampshire, 391–92
Karakul, 398
Leicester, 395
Lincoln, 395–96
long-wool, 395–96
medium-wool, 390–95
Merinos, 387–89
Montadale, 392
Oxford, 392
Panama, 397
Rambouillet, 389–90
Romeldale, 397
Romney, 396
selecting, 398–400
Shropshire, 392
Southdown, 392
Suffolk, 392
Targhee, 397
Tunis, 394–95
bunks, 430
classes, 386–87
diseases:
anthrax, 451–52
bloat, 453
brucellosis, 451
foot-and-mouth disease, 452
foot rot, 452
infectious, 450–53
lamb dysentery, 452–53
overeating disease, 450–51
pregnancy disease, 453
sore mouth, 450
stiff lamb disease, 453
tuberculosis, 451
equipment for, 429–30

Sheep (*Cont.*):
feeder lambs, feeding and management, 433–40
equipment for feeding, 438
fattening, 434–37
feed lot troubles, 438–39
kind to buy, 433–34
profit, sources, 434
selection, 405–07
where to buy, 434
feed racks, 430
foundation stock, selecting, 400–05
age, 404
body conformation, 401–04
production records, 404
housing, 430
marketing, 455–61
feeder lambs, 455–58
market price, factors influencing, 459–61
slaughter lambs and sheep, 458–59
wool, 461–65
parasites:
blow flies, 444–45
broad tapeworm, 447–48
coccidiosis, 449–50
external, 442–45
gid tapeworm, 448
grub in the head, 449
internal, 445–50
intestinal worms, 447
lice, 442–43
lungworms, 448–49
mites, 443–44
screw worms, 444
stomach worms, 445–47
ticks, 442–43
pastures for, 426–27
production, 381–85
opportunities in, 381–82
producers, classes, 382–84
sanitation program, 441–42
shearing, 427–28
slaughter:
grades and classes, 458
marketing, 458–59
Shelters, lamb feeding, 438
Shipping fever, cattle, 369
Shipping hogs, 170
Shorthorns, beef cattle, 187–88
Shropshire sheep, 392
Silage, average composition of common kinds, table, 21
Silver, L. B., 61
Simple-stomach animals, 4
digestion in, 26
Slaughter cattle:
classification and grades, 247–49

Slaughter cattle (*Cont.*):
  determining when to sell, factors, 253–55
  losses due to damaged carcasses, 255
  marketing, 249–53
Slaughter sheep and lambs, marketing, 458–59
Slot-type ventilation, laying house, 503–04
Sodium fluoride, 117
Soil, feed value affected by, 32
Sore mouth, sheep, 450
Sorghums, grain, source of carbohydrates, 12
Sotham, William H., 185
Southdown sheep, 392
Sows, *see* Hogs
Soybean oil meal, source of vegetable protein, 14
Soybeans, source of vegetable protein, 14
Sperm ducts, 583
Spoons, dehorning, 217–18
Spotted Poland China hogs, 63
Spraying cattle, 363–64
Stable flies, 363–64
Stanchion barn, dairy cattle, 313–17, 341–42
Standard ear-notching system, 105
Stiff lamb disease, 453
Stomach worms:
  cattle, 364–65
  sheep, 445–47
Straw loft, laying house, 504
Suckling period, management during, market hogs, 106–16
  anemia, 112–13
  castration, 113–14
  feeding, 106–12
    creep-feeding young pigs, 107–08
    pig starters, 108–10
    sow, 106–07
    synthetic milk, 110–12
  pasture, 115
  vaccination, 114–15
  weaning, 115
  weighing pigs at fifty-six days, 116
Suffolk sheep, 392
Sun porch, poults, 536
Surfactants, chicks, 523
Swine, *see* Hogs
Synthetic milk, feeding, 110–12

T

Tamworth hogs, 63–64
Tankage and meat scraps, source of animal protein, 13
Targhee sheep, 397
Teats, removal of extra, heifers, 332
Terminal markets:
  feeder cattle, 246
  feeder lambs, 456
Testicles, 583
Texas fever, 364
Ticks:
  cattle, 364
  sheep, 442–43
Trace mineral mixture, 18
Transmissible gastroenteritis, 151–52
Tuberculosis:
  cattle, 367–68
  poultry, 552
  sheep, 451
Tubes, dehorning, 217–18
Tunis sheep, 394–95
Turkeys:
  broiler production, 542
  brooder, 534–35
  brooder house, 534
  cannibalism, 541
  consumption, 474
  diseases, *see* Poultry, diseases
  feeders, 538
  feeds, 539–41
    antibiotics, 540–41
    arsenicals, 541
    required per pound of gain, 539–40
    water, 541
  finishing for market, 541
  litter, 534
  market classes, 565–66
  parasites, *see* Poultry, parasites
  pastures for, 537
  poults, *see* Poults
  production and management, 532–43
  range management, 537–41
  range shelters, 537–38
  rations, 539
  selection of variety, 532–33
  trends in poultry production, 472
Two-litter system, breeding, 85–86
Typhoid, poultry, 551

U

U.S.D.A. hog grades, 163–66
Undulant fever, hogs, 149
United Duroc Record Association, 59
Upgrading, pork production, 49
Urethra, 583
Utensils, milk, 343
Uterus, 582

V

Vaccination, pigs, 114–15
Vagina, 582

Vegetable proteins, 10
  sources, 14–15
Ventilation, laying house, 503–04
Vesicular exanthema, 150
Vitamins, 5
  A, 15–16
  B, 16–17
  calves, 330
  chickens, 509
  chicks, 521–22
  D, 17
  dairy cattle, 301
  E, 17
  feeding pigs on pasture, 130–31
  functions, 5–6
  measures of feed value, 31
  sources, 15–17
  supplement on grass, 204
Vulva, 582

W

Warts, cattle, 373
Water:
  beef cattle, 205
  calves, 331
  chickens, 509
  dairy cattle, 302
  equipment, chickens, 502–03
  feeding pigs on pasture, 134
  function, 6
  turkeys, 541
Watering facilities, 215
  chicks, 519–20
  poults, 536
Weaning:
  lambs, 428–29
  pigs, 115
Weather, feed value affected by, 32
Webber, R. U., 61
Weight:
  hogs, for selling, 162–63
  lamb to buy, 407
  pigs at fifty-six days, 116
Wethers, 406
Wheat, source of carbohydrates, 11
Wool:
  carpet, 464
  clothing, 464
  combing, 464
  fleece shrinkage, 464
  French combing, 464
  grades, 462
  grease, 464
  marketing, 461–65
  quality system, 462–64
  rejected fleeces, 461–62
Worming, market hogs, 117–18

X

X disease, cattle, 372–73

Y

Yorkshire hogs, 64–65

Z

Zeller, J. H., 65